FEB 22 1949

Biloxi, Miss., Assembly—May 23, 24, 25, 26, 1949

VOLUME XV FEBRUARY, 1949 NUMBER 2

The Southern Surgeon

University of Virginia Department of Medicine Number

Charlottesville, Va.

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Published Monthly
by
THE SOUTHERN SURGEON PUBLISHING CO.
701 Hurt Building
Atlanta 3, Ga., U.S.A.

Entered as Second-Class Mail Matter June 25, 1946, at the Post Office at Atlanta, Ga., Under the Act of March 3, 1879.

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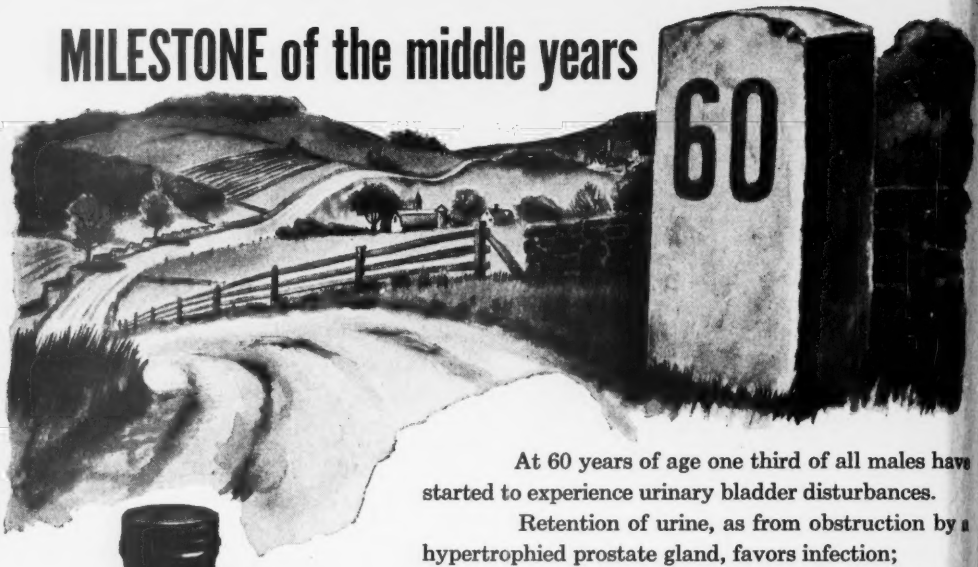

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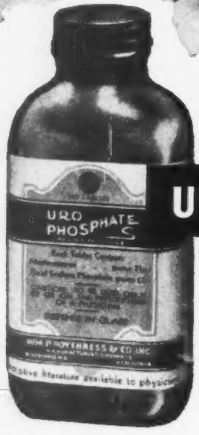

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Vol. XV, No. 2
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The Southern Surgeon Publishing Co.
February, 1949

THE MANAGEMENT OF SEVERE BLEEDING FROM GASTRIC, DUODENAL, AND JEJUNAL ULCERS

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HEMORRHAGE, next to acute free perforation, is the most urgent complication of gastric, duodenal or jejunal ulceration. An indication of its frequency is gained from reports which show that at the New York Hospital 18 per cent,[10] and at the Massachusetts General Hospital 34 per cent,[2] of all patients with gastric or duodenal ulceration requiring hospitalization are admitted because of bleeding. The incidence at the University of Virginia Hospital has been somewhat lower. Between March 1, 1925, and Sept. 1, 1947, there have been 1466 admissions with a clinical diagnosis of gastric, duodenal or jejunal ulcer. Among these admissions 262, or 17.8 per cent, were because of bleeding. When only those are included in which the diagnosis of ulcer was proved by x-ray, operation or autopsy, there remain 231 admissions for bleeding. These 231 admissions represent 167 patients, 38, or 22.8 per cent, of whom had more than one admission. The incidence of multiple admissions for hemorrhage is shown in Table I.

TABLE I

Number of admissions for bleeding	*Number of patients*
1	129
2	22
3	10
4	4
6	2

Incidence of Multiple Admission for Hemorrhage (University of Virginia Series).

From the School of Surgery and Gynecology, Department of Medicine, University of Virginia, Charlottesville, Virginia.

Bleeding, when it occurs, alarms the patient and often perplexes the physician. Moreover, this perplexity is not lessened by consulting the literature, for one finds extremes ranging from strong advocates for surgical intervention to one internist[14] who boasts never having sought surgical consultation. Even among the proponents of conservative management there is division of opinion as to whether to feed or to withhold food while the patient is bleeding. Much of the confusion undoubtedly stems from poorly defined terms and a failure to classify patients as to the rate and amount of blood lost. Indeed, one outstanding authority[14] reports a large series of cases, and introduces an innovation in management, without grouping his cases according to age or degree and rate of blood loss and without mentioning the presence or absence of shock.

In the study herein reported, patients with bleeding ulcer have been classified according to severity of hemorrhage. During the interval with which this report is concerned 167 patients have been admitted because of bleeding from gastric, duodenal, or jejunal ulcer. The only patients included are those who have given a history of, or who have been observed to have, gross hematemesis or melena. In each the diagnosis has been established by x-ray, operation or autopsy. No case is included in which the diagnosis is based upon clinical judgment alone. These cases have been grouped as mild, moderate or severe hemorrhages. When one individual has had more than one episode of bleeding, the most serious one has been selected as the basis for classification.

In the mild hemorrhage group are placed those patients who have not had shock or who have shown no significant changes in erythrocytes, hemoglobin or hematocrit. In the moderate hemorrhage group are placed those who have had reduction in hemogram to levels not lower than 3,000,000 erythrocytes with hemoglobin of 9 grams, and hematocrit 30 per cent. In the severe hemorrhage group are placed those who have had clinical evidence of shock (sys-

TABLE II

	Mild	*Moderate*	*Severe*
Duodenal Ulcer	12	24	91
Gastric Ulcer	5	4	20
Both Duodenal and Gastric Ulcer in Same Patient	0	0	3
Jejunal Ulcer	1	2	5
Total	18	30	119

Distribution of Cases in the University of Virginia Series Relative to Diagnosis and Severity of Bleeding.

tolic blood pressure below 80, pulse rapid and of poor quality and/or other notations on chart to indicate shock), or lowering of hemogram to levels at which the erythrocyte count fell below 3,000,000, hemoglobin below 9 grams and hematocrit below 30 per cent, or both shock and severe anemia. The distribution of cases in these groups is shown in Table II.

It is to be noted that there are 119 cases comprising the severe hemorrhage group. In the remainder of this paper only these cases of severe hemorrhage will be presented and analyzed in detail.

The mortality from bleeding ulcer is high. Holman[11] collected 3063 cases of hemorrhage treated medically as well as surgically, reported from 13 different clinics in this country and abroad. The death rate in this collected series varied between 1 per cent and 25 per cent and averaged 13.2 per cent. Bergh, Hay and Trach[4] in their study of the literature found that the average mortality rate for 2565 cases treated medically was 10.2 per cent, and for 214 cases treated surgically 29.8 per cent, giving an average for the entire group of 11.7 per cent. In the 119 cases of the severe hemorrhage group at the University of Virginia Hospital, there were 12 deaths, a mortality rate of 10.1 per cent.

There are undoubtedly many elements which enter into the determination of whether or not a given patient with severe bleeding from an ulcer will survive or die. Among the factors which have prognostic significance are the following:

1) The character of the ulcer
   a) The relation of the ulcer to the major arteries supplying the stomach and duodenum.
   b) The chronicity of the ulcer.
   c) The location of the ulcer, i.e., whether it is duodenal or gastric.
2) The age of the patient.
3) The initial response of the patient to conservative management.

The anatomic relationship of the ulcer and the major vessels of the stomach and duodenum is of utmost importance. Heuer, Holman and Cooper[9] have made several observations regarding this relationship as well as concerning chronicity. Their comments are essentially as follows: If the bleeding ulcer is duodenal, it is almost invariably located on the posterior duodenal wall and involves the pancreas. Severe hemorrhage occurs through erosions of the pancreatico-duodenal artery or one of its major branches, or in some

instances even the gastro-duodenal artery. If the ulcer is gastric, it is on the lesser curvature and has eroded the right or left gastric artery or their major branches. Conversely, the less serious hemorrhages occur in areas in which large arterial branches are absent. Moreover, it is known that the ulcer on the anterior wall of the duodenum is less likely to give rise to serious hemorrhage than that on the posterior wall, and that an ulcer of the fundus of the stomach is less dangerous with respect to hemorrhage than one of the lesser curvature. The hemorrhage is, therefore, arterial in nature and is derived from a single source rather than from the capillary oozing of a diffusely congested mucosa.

The chronicity of the ulcer influences the outcome. A chronic ulcer is characterized by a densely scarred unyielding base. If such an ulcer should cause erosion in one of the areas mentioned above, the result is an almost invariable pathologic picture. In or near the center of such a base is a wide-open artery which can neither retract or contract due to the rigid fibrous tissue of the ulcer.

The location of the ulcer, that is, whether it is gastric or duodenal, appears to be another factor influencing mortality. The cases in the University of Virginia Hospital Series have been divided into gastric ulcer and duodenal ulcer and each of these categories is subdivided into those cases treated medically as compared with those treated surgically. The results are shown in Table III. There are three series of cases other than the one reported herein in which the mortality rates were figured separately for each of the two types of ulcer. These data are presented in Table IV and indicate that the mortality rate for combined medical and surgical treatment in bleed-

TABLE III

	Gastric Ulcer *Cases*	*Deaths*	*Mortality Rate*
Treated medically	13	2	15.3%
Treated surgically	7	4	57.1%
Total	20	6	30.0%
	Duodenal Ulcer *Cases*	*Deaths*	*Mortality Rate*
Treated medically	80	2	2.5%
Treated surgically	11	3	27.2%
Total	91	5	5.4%

Comparison between the Mortality Rates in Bleeding Gastric and Duodenal Ulcer (University of Virginia Series).

TABLE IV

Author	*Duodenal*	*Gastric*
Segal, Scott, Stevens[16]	3.7%	30.0%
Aberhart[1]	7.0%	50.0%
Welch and Yunick[18]	6.3%	35.3%
University of Virginia Series	5.4%	30.0%

Comparison between Mortality Rates for Bleeding Duodenal and Bleeding Gastric Ulcer.

ing gastric ulcer is from 5 to 9 times as great as is that in bleeding duodenal ulcer.

The age of the patient is a factor which has considerable prognostic significance. Among 151 deaths in Seattle resulting from massive hemorrhage from gastric and duodenal ulceration, Blackford and Allen[5] found that 95 per cent of the deaths occurred in patients over 45 years of age. In Meulengracht's[15] series, 25 out of 26 fatal cases were older than 40 years. Allen and Benedict[2] report that among 20 cases of massive duodenal hemorrhage terminating fatally, 18 were over 49 years of age.

Holman[11] studied the mortality, collected from the reports of seven authors, in 1312 cases of hemorrhage. In relation to various age groups, the mortality rates were as follows: 1 through 29—6.7 per cent; 30 through 39—8.2 per cent; 40 through 49—13.6 per cent; over 50—20 per cent.

The relationship of age to mortality in the University of Virginia Series is illustrated in Tables V and VI.

Holman[11] attributes the higher mortality in the older groups to the probable greater susceptibility of older individuals to complications owing to blood loss and also to the higher incidence of arteriosclerosis with concomitant lack of elasticity in the walls of vessels and their failure to retract when they are eroded. He further points out that the increased mortality among the older patients has no relation to the chronicity of the ulcer, since, in the New York Hospital series which he reports, the average duration of symptoms of those patients who recovered was 4.2 years in contrast to 4.0 years for those who died.

It is well to remember that young patients sometimes die from massive hemorrhage; therefore one should beware lest the decidedly greater probability of death in the older age group create a sense of false security when dealing with a young individual.

Another very important prognostic sign has been emphasized by Holman.[11] This is the continuation or the immediate recurrence of

TABLE V

Age Group	0-19		20-29		30-39		40-49		50-59		60-69		70-79	
	Cases	Deaths	Cases	Deaths	Cases	Deaths	Cases	Deaths	Cases	Deaths	Cases	Deaths	Cases	Deaths
Duodenal	2	0	15	1	19	1	21	1	23	1	9	0	2	1
Gastric			1	0	1	0	4	1	6	3	5	1	3	1
Both Duodenal and Gastric in same patient							2	1			1	0		
Jejunal							3	0	1	0	1	0		
TOTAL	2	0	16	1	20	1	30	3	30	4	16	1	5	2
Mortality Rate	0%		6.2%		5%		10%		13.7%		6.2%		40%	

The Relation of Age to Mortality and Diagnosis (University of Virginia Series).

TABLE VI

	Under 45 Years of Age	*Over 45 Years of Age*
Number of Cases	53	66
Case Distribution	44.5%	55.5%
Number of Deaths	3	9
Mortality Distribution	25%	75%
Mortality Rate	5.6%	13.6%

Relation of Age to Mortality (University of Virginia Series).

bleeding during the first 48 hours after the patient has been hospitalized and managed by a conservative therapeutic regime. In this connection he has reviewed the reports of four other authors and has found the mortality after a satisfactory immediate response to medical treatment to range from 0 to 9.8 per cent. In his own series this figure is 6.4 per cent. On the other hand, the mortality after an unsatisfactory immediate response to medical treatment as evidenced by continuation or immediate repetition of bleeding varied from 27 to 74 per cent. In Holman's series, 46 per cent of this group were fatalities.

In 1931 Meulengracht[13] adopted the free feeding program and has subsequently written extensively on the subject. Briefly, his method consists in feeding a soft pureed diet to ulcer patients during the period of active bleeding. In 1939 he reported[14] 491 "profusely bleeding ulcers with gross hematemesis and gross macroscopic melena" treated by this method. Unfortunately, these patients were not classified as to the presence or absence of anemia or shock. His "mortality rate has been between 1 and 2 per cent." Still later he summarizes[15] an experience with 1031 cases of bleeding ulcer treated without surgical intervention and with a gross mortality of 2.5 per cent. This figure can be reduced to 1.5 per cent by the exclusion of all patients who died during the first 24 hours after admission to the hospital or those whose death was entirely or mainly due to causes other than bleeding.

Modifications of Meulengracht's method but with preservation of the principle of early feeding in contrast to the older "starvation regime" have been widely adopted and are effective in the majority of patients with hemorrhage. On the other hand, as is pointed out in a recent monograph[9] in cases of massive arterial hemorrhage from the erosion of a large artery, such as the pancreatico-duodenal, this method is analogous to the treatment of a patient with a severed radial artery with rest, diet and transfusions without attacking the bleeding point. From a rational point of view it must be considered inadequate.

During the period under study at the University of Virginia Hospital 101 of the 119 cases of severe bleeding were treated by non-operative means. No effort has been made to differentiate those treated by prompt feeding during the phase of active bleeding from those managed by the withholding of food and fluids during the same period. Of these 101 cases there were 96 survivals and 5 deaths, or a mortality rate of 5 per cent. Of the 96 survivals 36 or 39 per cent later had recurrent bleeding. Of these 36, 32 or one third of all the surviving cases required interval surgery for past bleeding. In this group there were 2 deaths, a mortality rate of 6.2 per cent.

At the pole opposite the teaching of Meulengracht, is that of Finsterer.[7] This Viennese surgeon pointed out that ulcers bleeding massively which can be attacked within the first 48 hours of the onset of bleeding should be treated surgically. This contention is supported by a 4.2 per cent mortality rate for subtotal gastric resection.

The pitfalls of rigidly fixed therapeutic routines are well known. Treatment is usually better when varied to fit the individual, keeping within the bounds of established principles. Mindful of these facts the following program is suggested as a guide in the management of the massively bleeding gastric or duodenal ulcer.

There is no sound reason why hemorrhage from a bleeding ulcer should be considered apart from the fundamental problem of severe hemorrhage in general which, as is well recognized, is a surgical problem. Therefore, the patient who is suffering from a bleeding ulcer should, from the very start, come under the supervision of a surgeon and should so continue until all threat of exsanguination ceases to exist. This statement is not intended to imply a lack of appreciation of the value of internist, gastroenterologist, and roentgenologist as members of a team cooperating to solve the problem, but it is made to emphasize that the surgeon by training, tradition and temperament is the logical captain of a team whose purpose it is to cope with hemorrhage.

Patients with severe hemorrhage from ulcers should be hospitalized and there must be at hand facilities for immediate and unlimited blood transfusions. Once the diagnosis of bleeding ulcer is established, the patient should be placed upon bed rest, sedatives if required, and frequent determinations of pulse, blood pressure and hematocrit should be made. The urgency for immediate and continued blood transfusion cannot be over-emphasized. Complete and prompt replacement of the blood lost by hemorrhage must be accomplished and efforts in this direction must not be relaxed until the

bleeding is brought under control and the blood volume restored to normal. It has been our practice to give the patient nothing by mouth during the initial period of observation. This, however, is not intended to imply that a starvation regime is favored, for as soon as bleeding has stopped, a nourishing diet should be started and increased as the patient continues to tolerate it. On a regime such as outlined above, bleeding will cease in the majority of cases. However, there are those in whom such management will not bring the hemorrhage under control. Persistent bleeding is evidenced by a continuation of a rapid pulse rate and a failure of the blood pressure to stabilize despite multiple blood transfusions. There may be other manifestations of hemorrhage, such as pallor, sweating, restlessness, hematemesis and melena. Normally the hematocrit should increase by approximately 5 points for every 500 c.c. of whole blood given. Failure to achieve such a response indicates continued bleeding. If the patient shows by any of these signs that he is still losing blood, then he should be operated upon. Failure to stop bleeding after 24 hours of vigorous non-operative therapy is an indication for operative intervention.

Operative procedures for the arrest of hemorrhage in such patients are attended by a high incidence of mortality. Thorstad[17] collected from the literature between 1931 and 1941 the operative mortality rates in all types of operations done for bleeding ulcer and found variations ranging from 5.1 per cent to 100 per cent. These statistics include, of course, not only operations done in the early stage of hemorrhage, but also procedures performed on patients who had been treated expectantly until they seemed hopeless and then subjected to operation as a last resort. Moreover, many reports are based on operations performed in the period preceding the introduction of chemotherapy, improved anesthesia and new methods in handling shock and postoperative pulmonary complications. With these adjuncts to surgery, massive hemorrhage can be attacked more safely.

As has been noted previously, Finsterer[7] a number of years ago advocated an early surgical attack on the bleeding ulcer. He showed that in patients operated on within 48 hours after the onset of bleeding, the mortality rate was significantly lower than in those operated on later. The experience of several other clinics lends evidence to the assumption that the mortality rate decreases when the period of expectant treatment is shortened. It is difficult to compare results among different clinics. Fortunately there are in the literature at least three reports in which the outcome of early operation is compared with that of late operation in the same clinic. These are summarized in Table VII and indicate clearly the need for a decision in

TABLE VII

Early Operation	*Cases*	*Deaths*	*Mortality Rate*
Finsterer[7]	78	4	5.1%
Heuer[10]	21	2	9.5%
Gordon-Taylor[8]	18	1	5.5%
Late Operation			
	Cases	*Deaths*	*Mortality Rate*
Finsterer[7]	74	22	30.0%
Heuer[10]	10	7	70.0%
Gordon-Taylor[8]	11	4	36.0%

Comparison between the Mortality Rates of Early and Late Operation.

the first 24 hours. Although the surgical mortality rate is higher in late cases which have continued to bleed despite medical management, these patients should not be denied operation.

One now comes to the consideration of the most satisfactory operative approach to the bleeding vessels. The literature contains reference to many procedures among which are excision or mass ligation or cauterization of the ulcer, pyloric exclusion, gastroenterostomy and pyloroplasty. While there are individual instances of success with any one of these methods, as a general rule they have been unsatisfactory. Distant ligation of the blood supply is advocated by some but the rich arterial anastomosis renders control of bleeding by this method uncertain. It is scarcely necessary to point out that vagus resection has no place in the management of the actively bleeding gastric, duodenal or jejunal ulcer. At the present time it is the consensus in most surgical clinics that resection of at least three fourths of the stomach with removal of the ulcer is the procedure of choice. During the phase of active bleeding, it affords a means of direct attack on the bleeding vessel and in addition it offers the probability of relieving the patient of his disease. There may occur, however, individual situations in which the procedure of choice cannot be carried out and in which some operation of lesser magnitude may be usefully employed.

During the period under study at the University of Virginia Hospital 18 of the 119 cases of severe bleeding were treated by surgical operation. These 18 cases have been divided into two groups: (1) those treated by what we consider to be adequate operation, namely, resection of at least three fourths of the stomach together with removal of the ulcer, and, (2) those treated by what we consider to be inadequate operation, e.g., excision or cauteriza-

tion of the ulcer with or without some type of short-circuiting procedure, gastric resection without removal of the ulcer, gastroenterostomy and pyloroplasty.

There were 7 cases classified as adequate with one death or a mortality rate of 14.2 per cent and there were 11 cases classified as inadequate with 6 deaths or a mortality rate of 54.5 per cent. These figures, while suggestive of a trend, are based on a series of cases too small in number to be of statistical significance.

Up to this point the discussion regarding therapy has been concerned with the patient who is actively bleeding. There is another group of patients who present a therapeutic problem, namely, those who have recovered from hemorrhage without the benefit of surgery. Repetition of hemorrhage is believed by some to be of importance in determining treatment. In the series herein reported, it is noted that 39 per cent of the patients who have survived one severe hemorrhage suffer another. Jordan and Kiefer[13] found that in a group of patients who had experienced one gross hemorrhage and who were followed for 5 years, bleeding recurred in 43 per cent. Sixty-nine per cent of another group who had bleeding on two or more occasions suffered further hemorrhages in the 5 year follow-up period. Holman[11] has noted that patients with chronic ulcer and with a history of present or past hemorrhage do not do well under a medical regime and are prone not only to have recurrent hemorrhage, but also to have a continuation of pain and other symptoms. In 1948 he reported on a 5 year follow-up[12] study of a group of 134 patients who were discharged from the hospital after recovery from bleeding without operation. Fifty per cent had recurrence of bleeding, 3.7 per cent died from recurrent hemorrhage and only 24 per cent were free from either pain or bleeding. In a group of 15 patients who had had indirect operative procedures carried out for bleeding, 46 per cent had recurrent bleeding, 6.6 per cent died because of recurrent bleeding and only 33 per cent were asymptomatic. These groups are contrasted with 53 patients on whom gastric resection was performed. Only 3.8 per cent had recurrence of hemorrhage, none had died and 87 per cent were asymptomatic.

For the patient who is no longer actively bleeding, factors other than bleeding must be taken into account before deciding upon therapy. For example, if the ulcerated lesion is in the stomach, the possibility of malignancy influences therapy more than the likelihood of recurrent hemorrhage, and if the lesion fails to heal promptly, operation will be undertaken not to prevent further hemorrhage, but because malignancy is feared. Likewise, factors such as age, sex

and response to medical management must be weighed before treatment can be planned.

Although each patient must be dealt with as an individual problem, the following general policy is offered, and with it a word of caution regarding fixed therapeutic regimes, as a guide to the management of this group of individuals. If the patient has suffered a single severe hemorrhage and does not have arteriosclerosis and if the ulcer is duodenal, a trial on medical management is definitely indicated. On the other hand, if the same patient has suffered more than one serious hemorrhage, there is distinct risk in continuing medical therapy. If the patient is in the arteriosclerotic group and has had one severe hemorrhage, and, in spite of adequate medical treatment, the ulcer is unhealed when the patient is seen, surgical intervention is indicated.

When surgery is decided upon, resection of three fourths of the stomach with removal of the ulcer, if possible, is the operation of choice. Objection to the other methods voiced previously is also applicable to this group of patients. Moreover, unhappy experience with hemorrhage subsequent to vagus resection places a questionable value on this procedure when hemorrhage has been a major feature in the ulcer problem.

This paper has been concerned with therapy and thus far nothing has been said about diagnosis. It is not our object to enter into a detailed discussion of the differential diagnosis of gastrointestinal bleeding, but we cannot close without a word concerning this phase of the problem. In many instances the presence of an ulcer will have been established prior to the bleeding episode. In others a careful history will leave little doubt as to the existence of gastric or duodenal ulceration. However, there are not infrequent cases of massive hematemesis or melena without any hint of the underlying disease. A report by Bulmer[6] indicates that 88 per cent of all hematemesis arises from gastric or duodenal ulcer, while Allen found that ulcer was the etiology in 67 per cent of patients with upper gastrointestinal tract hemorrhage. When the patient is not in shock, fluoroscopic barium studies, without manipulation, in the face of active bleeding are probably no more harmful than is early feeding. This procedure has been carried out in the Department of Roentgenology at the University of Virginia on numerous occasions without cause for regret. When the patient is not in shock, it is now the practice in this hospital to obtain gastrointestinal studies as promptly as possible on all undiagnosed cases of gastro-intestinal hemorrhage and when this procedure fails to establish the diagnosis, esophagoscopy is undertaken. On the other hand, when the patient

is in shock, obviously one must forego the advantage of accurate diagnosis and is obliged to proceed with therapy on the basis of the statistical probabilities.

Summary

1. Bleeding represents a substantial percentage of all hospital admissions for gastric, duodenal or jejunal ulcerations.

2. The expected mortality rate from severe hemorrhage, irrespective of treatment, is between 10 and 13 per cent.

3. The incidence of death in bleeding gastric ulcer is decidedly higher than that in bleeding duodenal ulcer, regardless of whether the treatment is operative or non-operative.

4. There is a direct relationship between the age of the patient and the mortality rate.

5. The more serious hemorrhages are arterial in nature and arise from erosions in the gastroduodenal, pancreaticoduodenal and right or left gastric arteries or their major branches.

6. The majority of severe hemorrhages will respond to conservative measures; however, many will not.

7. An important prognostic sign is the continuation or immediate recurrence of bleeding after the patient has been managed conservatively for from 24 to 48 hours.

8. Bleeding which fails to respond within 24 hours to conservative measures, or which soon recurs, should be dealt with by a prompt direct surgical attack on the source of bleeding.

9. The operation of choice is resection of at least three fourths of the stomach together with removal of the ulcer. However, in the poor risk patient, a less formidable procedure may be usefully employed.

10. The mortality rate from operations done during active severe bleeding from gastric or duodenal ulceration is high. However, in the cases where there is failure to respond promptly to medical management, the risk of surgery is probably less than that from hemorrhage.

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ANNULAR PANCREAS, REPORT OF A CASE

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ANNULAR pancreas is an infrequently encountered abdominal anomaly, first described by Tiedeman in 1818. McNaught[3] reviewed the literature in 1933 and found 40 recorded cases. The total was brought to 48 in 1942 by the report of a case from this hospital by Dr. E. P. Lehman.[5] He reviewed the anatomy, embryology, pathology, clinical significance, and treatment of this unusual condition.

A review of the literature since then reveals 5 recorded cases. The single cases of Chapman[1] and Stoffer[7] were non-operative. Custer and Waugh,[2] Gross and Chisholm,[4] and Goldyne and Carlson[3] reported single cases of successful operative treatment.

There have been 14 cases treated surgically, including the case herein described. Of these, 5 patients have died in the immediate postoperative period. Vidal[8] recorded a successful operative case of an infant of 3 days in which he performed a posterior gastro-enterostomy. The case of Gross and Chisholm was that of a successful side-to-side duodenojejunostomy in a 3 day old infant. The other operative cases have been in the older age groups.

It is generally thought that the anomaly occurs because the ventral anlage of the gland fails to rotate normally, leaving the strip of glandular tissue around the duodenum. The condition has been rarely mentioned by the roentgenologists and surgeons preoperatively, due, no doubt, to its rarity.

Surgical treatment has either been a gastro-enterostomy, or duodeno-enterostomy or direct attack with resection of the constricting ring of pancreatic tissue. Following the latter procedure, pancreatic fistula may occur. It is to be remembered that the ducts originate near the head of the pancreas anteriorly with great consistency. In order to avoid the occurrence of pancreatic fistula, the ring should be divided as near the head of the pancreas as the safety of the pancreaticoduodenal vessels will permit, as pointed out by Lehman.[5]

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Case Report

Infant F. D. B. (History No. 179106), white female, age 4 days, was admitted to the University of Virginia Hospital May 9, 1942, with a history of vomiting and jaundice since birth.

The infant was born at home of a 26 year old mother after a normal period of gestation. There were 2 siblings, ages 5 and 2, alive and well. Physical examination revealed a 5 pound dehydrated, icteric, acutely ill infant who was vomiting bile-stained fluid.

Laboratory study revealed hemoglobin 18 Gm., red blood count 5.99 million, white blood count 12,140, with a normal differential. Stool examination was negative for bile. Icterus index was 111 with positive direct and indirect van den Berghs. The Wassermann was negative; the clotting time 4 minutes.

The baby was given subcutaneous and intravenous infusions but continued to vomit. On the third hospital day barium was administered under fluoroscopic control. The stomach and duodenal bulb were dilated, with no barium flowing past the duodenum immediately. After 18 hours there was still a residue in the stomach and a thin film in what appeared to be the small intestine. Surgical consultation was sought and exploration advised.

Fig. 1. Sketch of findings at exploration.

The following day, after administration of vitamin K, exploration was carried out under drop ether anesthesia. An upper right rectus muscle-splitting incision was made and the stomach and first portion of the duodenum found large and dilated. The obstruction was in the second portion of the duodenum where an annular pancreas encircled the duodenum anteriorly (fig. 1). The small intestine and colon were small and undeveloped. The annular portion of the pancreatic tissue measured 1 by ½ by ½ cm. This was carefully

resected from the anterior wall of the duodenum with ligation of the stumps of pancreas with fine silk. This left a constricted portion of duodenum, measuring 1 cm. in length and ½ cm. in circumference. There was no unfolding of this portion of the duodenum. The common bile duct entered at the upper edge of this constriction. The gallbladder was of normal size.

It was decided to incise the strictured portion of the duodenum longitudinally and suture it transversely to relieve the obstruction. This incision was made in the anterior wall, entering the lumen of the duodenum above and below the stricture. No definite lumen in the narrowed portion of the duodenum could be found with a probe. The incision was then carried further

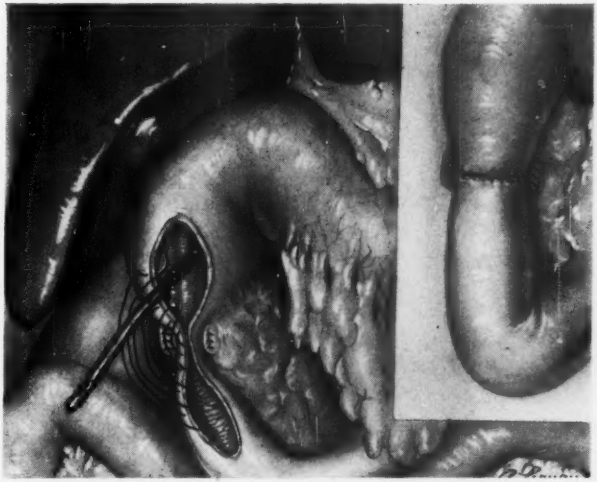

Fig. 2. Sketch of operative procedure showing incision into duodenum above and below constriction, with completed repair in the insert.

into both portions of the duodenum and an end-to-end type of anastomosis carried out using fine atraumatic chromic catgut. A small tube was inserted through the nose into the stomach and pulled through the anastomosis into the jejunum for feeding purposes (fig. 2). The abdomen was closed in the usual manner, and the condition of the infant at the end of the procedure was satisfactory.

Pathologic study of the tissue removed revealed pancreas showing slight fibrosis.

There was postoperative vomiting with some febrile reaction. The baby started having stools on the first postoperative day. The abdomen remained soft and non-distended. On the seventh postoperative day the temperature rose to 102.6°. The skin stitches were removed and there was some bile-stained drainage from the lower end of the wound. Jaundice became less apparent; bile appeared in the urine and feces. The infant expired on the ninth postoperative day. Permission for necropsy was not granted.

Summary

We have recorded an additional case of annular pancreas, that of a 4 day old infant who was treated surgically and died on the ninth postoperative day.

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MORTALITY FOLLOWING PROSTATIC SURGERY WITH SPECIAL REFERENCE TO THE ROLE OF CHEMOTHERAPY

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IT IS often instructive to appraise the failures following major surgical procedures in order that we may approach the future more intelligently. There is hardly a phase in all surgery in which the management has undergone more marked changes with such striking improvements in end results as in the field of prostatic surgery. One of the chief reasons for the reduction in mortality rates in the last decade has been the advent of chemotherapy. It is the purpose of this study to present for comparison the causes of death following prostatectomy at this institution before and after the use of chemotherapy. For comparative purposes all deaths following various types of prostatectomy (perineal, transurethral, suprapubic and retropubic) for the approximate decade before the advent of chemotherapy in 1938 and the approximate decade since that year have been analyzed.

In the decade before chemotherapy the mortality as reported by Neff and Kirby for all types of prostatic surgery in this hospital was in the neighborhood of 6.3 per cent. As a matter of comparison from July, 1938, until Oct. 10, 1947, there were 901 prostatic operations on the resident service with a mortality rate of 3.1 per cent in ward patients. At the same time the mortality rate of the senior author (S.A.V.) was studied and it was found in the last consecutive 510 prostatectomies that 6 deaths had occurred with an overall mortality rate of 1.1 per cent in private patients. Both these figures show a continued reduction in mortality in prostatic surgery during the past decade from that of the previous. This is only a part of the general reduction in prostatic mortality rates that have occurred during the past five decades since the advent of prostatectomy as the standard therapeutic procedure for this obstructive hyperplasia.

There are a number of factors other than chemotherapy which have contributed to this improvement. Among the most significant are: 1) Personal and detailed pre- and postoperative care of these

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aged patients. Careful postoperative surveillance in which tubes and drainage systems are kept in proper order, catheters unblocked, has been invaluable and lifesaving. 2) Technic. Improvement in operative technic has been tremendous. This has been made possible in the main by the amazing development of special instruments, catheters, etc. 3) Better trained surgeons. Better training of individuals who are doing prostatic surgery, i.e. the development of the field of urologic surgery itself. This has led to an improved appreciation of anatomy and of pathologic conditions for which the operation is directed. It can be categorically stated that there is no field in surgery where mortality and end results are more directly in proportion to training, experience and the innate skill of the operating surgeon as in the field of urology. 4) Blood replacement is now commonplace, rapid, efficient and often lifesaving. The measurement of blood loss is scientifically accurate and its knowledge most valuable. 5) The maintenance of fluid and electrolyte balance has been vital in the care of these patients so commonly afflicted with varying renal damage. 6) The maintenance of the proper state of nutrition, especially protein balance and adequate vitamin intake, has led to less shock, more resistance to infection, shorter convalescence and better wound healing. 7) Improvement in anesthesia has also been a marked asset in the surgery of individuals in this age group. 8) Early ambulation has reduced the incidence of cardiovascular accidents such as embolism and at the same time improved the respiratory status and general well being of patients in addition to being a vital stimulus to the mental outlook. 9) One of the most important factors in the present day low rates has been chemotherapy. It is with particular reference to this that we have studied the cause of death in all patients dying following prostatic surgery in approximately these two decades.

TABLE I

Deaths	1928-37 (31 cases)	1937-date (39 cases)
Infections	15 (50%)	2 (5%)
Shock (Rupture Bladder, etc.)	5 (16%)	15 (37%)
Cardiovascular	8 (24%)	13 (32%)
Ulcer, duodenum, rupture	1	1
Hemolysis	1 (Transfusion)	1 (H_2O in blood stream)
Unclassified (Hemorrhage, colitis, leukemia, typhoid, etc.)	1	7

In Table I a summary of the careful analysis of the deaths both before and after chemotherapy is shown.

It can be noted that of the 31 consecutive deaths occurring between 1928-37 50 per cent were due directly to infections. After the advent of chemotherapy this percentage has fallen to only 5 per cent. During this latter period all types of chemotherapy were freely used both pre- and postoperatively.

In the matter of deaths from shock it can be noted that the percentage of deaths from this cause has risen from approximately 16 per cent to 37 per cent which is almost a two and one-half fold increase. This mortality is in the main due to technical difficulties such as rupture of the bladder or prostate, undue blood loss and prolonged operating time in which more tissue is removed. One of the reasons for this increase is certainly due not to less experience but to a more bold or complete type of operation. During the prechemotherapeutic decade a limited use of the transurethral instruments was in vogue and an attempt to remove the entire hypertrophied portion of the prostate was rarely made. The objective at that time was the simple procurement of an aperture through which the patient could void, thus leaving a future return of obstruction possible. Since 1938 a more complete operation has been routinely attempted in this clinic. Only in exceptional instances of extreme age and short expectancy of life is a mere aperture made through the adenomatous prostatic urethra. In practically every instance at this clinic we attempt to remove all the adenoma down to the prostatic capsule. In carrying out such an extensive procedure which offers the patient a far more permanent and satisfactory functional result it is only natural that there will be an occasional accident such as rupture of the prostatic capsule accompanied by undue hemorrhage, shock and sepsis. Mortality occurring after all these instances has occurred in the main in the hands of young operators who are gaining experience. A slight increase in mortality rate from this cause is therefore the expected result. It should be stressed that this rise is more apparent than real because the total mortality in the last decade in over 1400 cases is considerably reduced over that in approximately 500 odd cases previous to 1937. The mortality rate therefore in the latter decade from such causes had actually only risen from 1.0 to 1.07 per cent.

Cardiovascular accidents showed a slight rise probably because we now operate on more and older patients. In the 1928-37 decade there were a number of patients in whom prostatic surgery was considered too hazardous because of the age of the patient and the risk involved so that a simple suprapubic tube was inserted instead. It

should be pointed out that since the chemotherapeutic era began a larger number of patients were subjected to prostatic surgery and only in extremely rare instance in 1400 odd cases was prostatectomy rejected because of the age or physical condition of the patient. The average age of patients undergoing surgery during the last decade has risen to 75.2 years whereas in 1928-37 it was only 68.3 years.

It is evident from data included in Table I that chemotherapy has been one of the vital factors in the general reduction of mortality in prostatic surgery and that infection is no longer an important cause of death. The reduction in mortality from infections has brought more sharply into focus the vascular and other accidents attendant upon this type of surgery. Still further perfection in technic will reduce deaths from the latter causes.

Conclusion

Mortality in prostatic surgery has continued downward in the last five decades as the result of many factors. The advent of chemotherapy has reduced the death rate from infection following operation in the magnitude of 90 per cent so that infection is no longer a major cause of death. The mortality rate following prostatectomy on this service has fallen to 3.1 per cent for the residents in training in their last 901 prostatectomies and 1.1 per cent for private patients in the last 510 prostatectomies.

THE TREATMENT OF INTERTROCHANTERIC FRACTURES

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MORE than 95 per cent of the fractures involving the intertrochanteric region occur in the aged. Hence, the problems and complications that arise require a good deal more than mechanical dexterity and knowledge of a few medical fundamentals. The decline in the mortality rates from intertrochanteric fractures of the femur is due mainly to the combined efforts of the medical and orthopedic groups.

DEFINITION

The term intertrochanteric fracture is used loosely to include all of the injuries in and about the trochanters, i.e., the peritrochanteric extracapsular type, the true intertrochanteric variety, and the subtrochanteric fractures.

DIAGNOSIS

It is almost impossible to differentiate clinically these injuries from fractures of the neck of the femur. The leg may be shortened and maintained in eversion. Pain is variable and is often referred to the knee. Many of the patients show evidence of immediate moderate shock; others may develop symptoms of delayed shock within 24 to 48 hours after injury. We have seen a large number of adduction, flexion and internal rotation deformities suggesting a diagnosis of posterior dislocation. It is believed that the latter deformities occur when the patient falls toward the affected side. Roentgenograms must be taken in order to make a conclusive diagnosis.

TREATMENT

The study of the evolution of the treatment of these injuries at the University of Virginia Hospital has been most interesting. Fifteen years ago all cases of fractures in and about the hip were treated by the use of Russell's traction. The mortality rates were well below average and the end results were good. During that period the well-leg traction principle made its appearance and was given a short trial. The complications from its use were many, and it was decided to continue only the use of Russell's traction.

Patients were hospitalized for an average of 11 weeks. Bedsores

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and other complications seemed to develop only when good nursing care was not available. All patients were seen routinely by our medical consultants. Blood and urine studies including estimation of blood urea were done on all patients. Patients were instructed to move themselves about in bed, deep breathing exercises were instituted, and back rests were provided within 12 hours after admission.

Fig. 1. Anteroposterior view of hip showing Neufeld nail in place.

Fig. 2. Oblique view of hip described in Figure 1.

Therapeutically the use of Russell's traction was ideal. Economically, long hospitalization periods and special nursing care placed a financial burden upon many patients and their families. Although the mortality rate was well below 10 per cent, it was felt that a few cases of hypostatic pneumonia could have been prevented had it been possible to get the patient out of bed and up in a wheelchair more rapidly.

In the early 1940's a change to the Neufeld and Blount nails was made in all cases in which the bone was not badly comminuted and in which medical study in consultation with the internists revealed fair operative risk (figs. 1 and 2).

The McLaughlin plate attached to a vitallium nail has been used recently on a number of cases (fig. 3).

Badly comminuted fractures sometimes defy open reduction. In these cases either a hanging cast or continued Russell's traction has been used (fig. 4).

Fig. 3. McLaughlin plate and nail 4 weeks postoperative.

Fig. 4. Comminuted fracture treated by the use of the hanging cast 9 weeks after injury.

Difficulty was experienced during the war years in obtaining a good grade of moleskin adhesive. As a result large, painful blebs developed almost universally about and under the adhesive. Temporarily, the use of skeletal traction through the femur was substituted with very satisfactory results. The use of moleskin in most cases has been resumed. We have no objection to the use of skeletal traction other than that it is no more effective and is certainly more difficult to apply than skin traction.

Our present treatment of these fractures has been followed for 8 years. On admission, roentgenograms of the normal and affected hips are taken. The former is to help establish the length of the nail should surgery be indicated. The extremity is placed in Russell's traction, the patient is treated for shock if present, and the routine blood work is ordered. Pre- and postoperative intramuscular penicillin is administered. Medical consultation is obtained, and the patient's ability to take anesthesia is determined. Dicumarol and heparin have not been used routinely since we are uncertain as to

the control of these drugs. Fluid balance and protein intake is checked, and the patients are encouraged to move and sit up in bed. When possible, private nurses are obtained.

Fig. 5. Neufeld nail placed much too far through the head.

Fig. 6. Same case after removal of Neufeld nail. Fractures are healed.

After 3 or 4 days, if the patient's condition permits, an open reduction is done. The choice of anesthesia is left to the discretion of the medical service. They have suggested the use of sodium pentothal in a large number of cases, and thus far there have been no serious complications resulting from its use.

The operative procedure differs very little from that used in other hospitals. A lateral incision is employed. The trochanter and about 3 or 4 inches of the shaft are exposed. The fractures are manipulated if necessary. Most of our cases are well reduced after 3 or 4 days in traction. A guide wire is passed from below the trochanter through the neck and into the head. Anteroposterior and lateral roentgenograms are taken and developed in one minute in the dark room which adjoins the operating room. We have developed a cassette holder which enables us to obtain excellent anteroposterior and oblique views of the neck of the femur (fig. 7). The usually difficult oblique view is obtained by flexing the knee and hip. The plate is placed against the oblique corner of the box, and the tube

is angled toward the plate from across the table. If the position of the wire and the fragments are good, one of the several types of appliances is applied. The wound is carefully closed to avoid dead

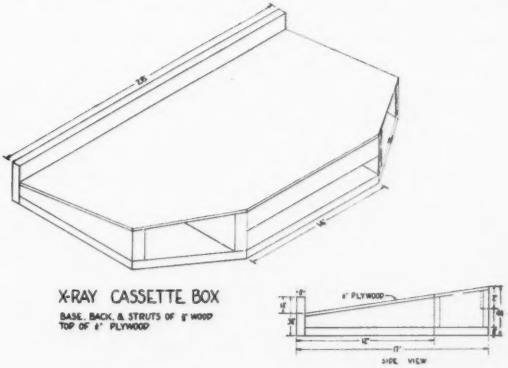

Fig. 7. Diagram of the cassette box.

space, and balanced traction is reapplied. After 3 or 4 days, many of the patients can be allowed up in a wheelchair. Traction is intermittently kept on for 2 weeks, and the patient may, after that time, be discharged.

No weight bearing is allowed until there is roentgenologic and clinical evidence of complete union. The patients may be allowed up in a chair or walker at home. The average aged patient is not to be trusted on crutches.

Complications

Delayed union, coxa vara, and arthritis, while troublesome, can be relieved by further immobilization, rest, local heat, and in some cases by secondary osteotomy.

Pneumonia, cystitis, and bed sores can be avoided by the use of the antibiotics and good nursing care.

Embolism, it is believed, can be partially prevented by keeping the patient active and perhaps by the carefully controlled use of dicumarol. There will always be a small mortality despite the best of care. The aged human mechanism is at best a rather fragile, easily upset system, and deviations from the minutiae of good treatment are readily felt.

We have found no need to remove the nails except in cases where they have protruded through the head or are otherwise badly placed (figs. 5 and 6). Non-union has been practically non-existent.

Statistics

One hundred and eighty cases have been treated in a 15 year period. One hundred and thirty-one cases had Russell's, Buck's, skeletal or hanging cast traction. Forty-nine cases had open reductions with one of three varieties of appliance being used. The age group varied from 54 to 93 years, for an average of 71.8 years. Females comprised over 80 per cent of this group. Healing time averaged 11 weeks. There was no great speedup of healing in the operated cases. Mortality rates were established on the basis of a minimal time of 4 months. Every patient whose death occurred within that period was included. The mortality rate from 1935 to 1940 was 12 per cent. Since 1940 it has averaged about 8 per cent. The 4 month period was chosen because complications within that period can often be attributed to the injury.

Summary

The evolution of treatment of intertrochanteric fractures at the University of Virginia Hospital is given and the present method of treatment is outlined. Team work between the orthopedic and medical staffs, we feel, is responsible for the lowered mortality rates. The operative treatment has been responsible for reducing the economic burden on the patient and possibly may be credited with helping to diminish the mortality rate. Healing time has averaged 11 weeks, and hospitalization time in the operative cases 19 days. The average time for resumption of normal locomotion has been about 26 weeks.

VENTRICULOGRAPHY IN THE LOCALIZATION OF ABERRANT POST-TRAUMATIC INTRACRANIAL CLOTS

Report of a Case of Acute Subtentorial Subdural Hematoma

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INTRACRANIAL hypertension due to hemorrhage with clot formation is one of the most common early complications of relatively mild head injuries. Since these lesions can occur anywhere within the skull, it is well to emphasize the necessity for their accurate localization, especially since their surgical removal offers the only chance for recovery.

The syndrome of a head injury, with or without loss of consciousness, followed by a lucid interval and then by gradual clouding of the intellect with signs of increasing intracranial tension, has come to be synonymous with epidural or subdural hemorrhage. Its location is usually in the temporoparietal region, yet it is obvious, as experience has shown, that hemorrhage in other locations deserves more consideration than it has in the past. It is generally accepted that when an interval hemorrhage is suspected, "diagnostic burr openings" should be made. Some authors advise bitemporal, and others biparietal, burr exploration, whereas some advise a burr exploration in each quadrant of the skull (Raaf,[8] King,[6] Munro[7]) in order to localize the clot.

Gross and Savitzky[5] in 1942 reported 3 cases of anterior fossa epidural hemorrhage. In the first case, the lesion was found at autopsy after negative bilateral temporoparietal burr openings. As a result of this experience, they suggested that an additional burr opening be made in the frontal region if the temporoparietal exploration is negative.

In many instances, when exploratory burr openings are negative, the patient's downhill course is explained on the basis of cerebral edema, and certain authors advise that if burr opening exploration is negative, and "intracranial pressure continues elevated to a dangerous level," a subtemporal decompression should be carried out.[2] Although cerebral edema may cause this picture, more often accurate localization will show a clot somewhere within the skull. In many of these cases at autopsy an unusually situated extradural,

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subdural, or intracerebral clot may be found which could not have been localized by routine burr opening exploration.

It is our purpose in this presentation to emphasize the value of ventriculography in cases where an acute post-traumatic intracranial hemorrhage is suspected, and the usual diagnostic burr opening exploration is negative. It would seem pointless to make additional burr openings when air can be introduced into the ventricular system and accurate localization obtained. The likelihood of missing any expanding lesion after this procedure is almost negligible. Even after the removal of a subdural or extradural clot, if the brain bulges into the opening, ventriculography is indicated.

We have followed this routine for several years after a very revealing experience early in 1941. One of us (W.G.C.) was called in consultation to see a patient who presented a typical picture of delayed intracranial hemorrhage. The patient had fallen down a flight of steps 60 hours before, and, after a period of unconsciousness, had regained her mental faculties for 48 hours, then gradually became stuporous and later comatose. Bilateral burr openings were made, but, except for a very tight brain, no abnormalities were noted. In spite of this negative exploration, it was believed that only a localized hemorrhage could account for the patient's condition; therefore, ventriculograms were made. These disclosed a large mass lesion in the left frontal lobe which proved to be an intracerebral clot, and after its removal the patient made a prompt and complete recovery. This case illustrates the value of ventriculography for accurate localization when a post-traumatic intracranial clot is suspected, and bilateral burr opening exploration is negative.

To emphasize our point further, we wish to report a case of acute subtentorial subdural hematoma localized by ventriculography after a negative bilateral burr exploration.

Case Report

G. M., aged 32, a white male, was admitted to the University of Virginia Hospital on Aug. 20, 1942. Two hours before admission the patient had had an argument with one of his neighbors who shot him with a shotgun from a distance of approximately 30 yards. Most of the shot lodged in the left side of the head and the left shoulder. The patient stated that he was not rendered unconscious and, although he felt a terrific jar against his head, he was not knocked to the ground.

On admission, the patient was bleeding slightly from all the small wounds. He cooperated for examination and was perfectly rational. The neurologic examination at that time was negative. The patient got along fairly well until August 22 (2 days later) when he became confused and later drowsy. A few hours afterwards, he was comatose. Neurologic examination at this time

revealed essentially normal findings except for hypoactive tendon reflexes throughout. Repeated neurologic examinations were made in order to detect inequality of the pupils and signs of pyramidal tract involvement, but at no time was either noted even though the patient was seen at least five times during the night. The only constant finding was hypoactivity of all tendon reflexes. Lumbar puncture revealed clear fluid under pressure of 500 mm. of water. X-ray films of the skull revealed nothing of significance. The clinical impression was that the patient had a subdural hematoma.

The patient was then taken to the operating room and a burr opening (J.M.G.) was made in each temporoparietal region. The only abnormality found was an unusually tight brain. Because of this, air was introduced into the lateral ventricles. Ventriculograms revealed no distortion of the ventricular system, but a moderate degree of internal hydrocephalus. The clinical impression was that the patient had an obstruction in the posterior fossa, possibly a hematoma.

The patient was then returned to the operating room where he was prepared for a suboccipital craniectomy. This was done through a midline approach. A small burr opening was made in the occipital bone on each side of the midline, and these holes were connected and enlarged with rongeurs until an opening about 5 cm. in diameter had been made. The dura appeared under tension and had the bluish discoloration which is characteristic of an underlying collection of subdural blood. As soon as the dura was opened, two clots extruded themselves under pressure, and a moderate amount of dark blood oozed out. The hematoma, containing about 45 c.c. of blood, was evacuated leaving an intact arachnoid membrane.

After hemostasis had been obtained, the wound was closed in layers except for the dura which was left open.

The patient showed marked improvement following operation, and in a few hours he was conscious and able to answer questions. After an uncomplicated convalescence of 18 days, he was discharged in good condition. He was seen in the Out-Patient Department 6 months later, at which time he was asymptomatic and had returned to his previous occupation (farming).

Comment

This patient had a typical history of a delayed post-traumatic intracranial hemorrhage. When admitted to the hospital, he was rational and had no apparent involvement of the central nervous system in spite of the nature of his injury. He remained conscious for 2 days; and then, within a period of 24 hours, he became restless, stuporous, and finally comatose. Several examinations failed to show any localizing signs. All tendon reflexes were hypoactive. There was no weakness of the extremities, and the pupils were equal and reacted to light. The progressive loss of consciousness, together with a spinal fluid pressure of 500 mm. of water, indicated that the intracranial pressure was at a dangerously high level. Routine burr exploration failed to show the clot which would have escaped detection if ventriculography had not been employed.

Discussion

This case is unique in our experience, and extensive search of the literature has failed to show a similar case. The papers by Coblentz and Schreiber are the only ones on subdural subtentorial clots which have been reported in detail in the literature. W. S. Craig[4] has shown by his studies at autopsies of 126 newborns that subtentorial hemorrhage is not an uncommon result of birth injury. The lack of reports of this type of clot in adults would make one think that it is a very unusual complication of ordinary head trauma.

In 1939, Schrieber[6] reported 2 cases of chronic subdural hematoma in the posterior fossa. His first case he attributed to a birth injury, but since the patient got along fairly well until 4 years of age, this etiology is open to discussion. His preoperative diagnosis was cerebellar tumor, and at operation a subdural cyst containing yellow fluid was found. His second case was that of a 29 year old woman in whom a chronic cerebral subdural clot was suspected. Trephine exploration was negative, and ventriculography disclosed internal hydrocephalus. At operation, a chronic subdural clot containing yellow fluid was found overlying the right cerebellar lobe. Both patients made a complete recovery.

In 1941, Coblentz[1] reported the first subtentorial subdural hematoma diagnosed preoperatively and treated surgically which we have been able to find in the literature. His patient, a baby born after normal delivery, progressed normally until the fourth day when it was noted that the fontanel was full and the head slightly enlarged. On the ninth day of life, the baby seemed drowsy and the head was definitely enlarged. The neurologic examination was negative except for hyperactive reflexes. The spinal fluid was bloody. Several punctures were done through the fontanel, and finally ventriculograms were made which revealed internal hydrocephalus. Posterior fossa exploration was carried out, and a chronic subdural hematoma was found. The patient was discharged 8 days after operation at which time it was apparently making a complete recovery.

These 3 cases and our own are the only successfully treated subtentorial subdural clots reported so far. Our case seems to be the first one of an acute subtentorial subdural hematoma which has been successfully treated.

The origin of subdural hematomas in this region is probably due to tears in the dural sinuses. To this one may add rupture of the small veins which go from the cerebellar cortex to the transverse sinus. Another type of hemorrhage in the posterior fossa may be of middle meningeal origin, but this gives rise to an epidural clot.

Coleman and Thompson[3] have suggested a syndrome for epidural hemorrhage in the posterior fossa. According to these authors, the clinical picture is characterized by increasing stupor, hypotonia and areflexia. Our case of subdural hematoma presented a clinical picture similar to their case of extradural clot.

Post-traumatic subdural hematomas in the posterior fossa should be amenable to surgical treatment and are probably not as uncommon as one may believe. Most of these lesions will be found and successfully treated when ventriculography becomes a routine method of studying patients with unexplained early intracranial pressure due to trauma.

SUMMARY

1. The importance and necessity of ventriculography in the localization of aberrant intracranial clots is emphasized.

2. A case of an acute subtentorial subdural hematoma is reported.

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BRONCHIOGENIC CARCINOMA

A Study of 115 Cases from January 1940 to January 1948

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CANCER of the lung is appearing with greater frequency in statistical reports. Unquestionably, part of the increase is a result of improved diagnostic methods, and a more acute realization of the possible occurrence of cancers of the lung in all adults who present pulmonary symptoms. With proper allowance for that factor, it would seem reasonable to expect that the ultimate level of incidence of cancer of the lung would equal or exceed the incidence of carcinoma of the stomach. This is suggested by numerous recent surveys.

Additional statistical studies serve the purpose of helping to establish, as accurately as possible, a true picture of cancer of the lung in all its variations. Contrary to many series of cases reported, this series deals with inhabitants of small towns and rural areas, where the irritating substances found in city atmospheres are diluted. Rienhoff's[2] emphasis on urban and industrial backgrounds for bronchiogenic carcinoma is therefore little apparent as an etiologic factor in this series.

The present study of 115 cases from the University of Virginia Hospital includes all cases seen in the 8 year period from January 1940 to January 1948. The sex, age and color distribution of patients is shown in Table I and Figure 1. These data are not at variance with those appearing in other published reports. The sex ratio of 98 males (85 per cent) to 17 females (15 per cent) is approximately the commonly reported ratio of 4 males to 1 female. Only 5 of the 115 patients were less than 40 years of age.

There were 11 colored males and 5 colored females in this series. The presence of only 13 per cent of colored patients is interesting since the colored population in Virginia is approximately 25 per cent of the total population. General admissions to the University of Virginia Hospital are 84.5 per cent white and 15.5 per cent colored. The number of cases of carcinoma of the lung in this hospital may not represent the true incidence of cancer of the lung in the colored race because of the unwillingness or inability of colored patients to apply to the hospital for treatment. The colored race must be ex-

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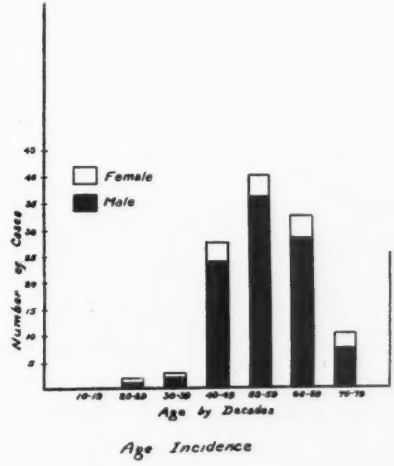
TABLE I

SEX, AGE AND COLOR DISTRIBUTION

Total Cases: 115
Race: White, 100 (87%); Colored, 15 (13%)
Sex: Male, 98 (85%); Female, 17 (15%)

	Age	*Male*	*Female*	*Totals*	*Per Cent*
	20-29	1	1	2	1.7
	30-39	2	1	3	2.6
Cases	40-49	24	4	28	24
By	50-59	36	4	40	35
Decades	60-69	28	4	32	28
	70	7	3	10	8.7

(Youngest patient: white female, age 27. Oldest patients: white males, age 75 (3 pts.)
Age (Average): 55.8 years, male; 56.2 years, female



Age Incidence

Fig. 1

posed to factors of irritation to the lungs to the same degree or greater as the white race.

Symptoms. The relative occurrence of presenting symptoms is shown in Table II. Cough is, as in all reports, at the head of the list, and since cough is common to practically all deviations from the

TABLE II

SYMPTOMS IN ORDER OF FREQUENCY
Total Patients: 115

	Number of Patients	*Percentage*
Cough	96	83
Weight Loss	89	77
Pain in Chest	66	52.4
Hemoptysis	64	55.6
Dyspnea	48	41.7
Weakness	44	38.8
Upper Respiratory Infection, influenza, pneumonia, etc.	40	34.8
Malaise	34	29.6
Anorexia	28	24.3
Pre-existing pulmonary disease (Bronchiectasis, tuberculosis, asthma, chronic bronchitis, etc.)	26	22.6
Pain in hand, arm, neck, spine, shoulder, hip (Probably due to metastases)	18	15.7
Wheezing	17	14.8
Fever	15	13.0
Orthopnea	8	6.9
Hoarseness	7	6.1
Cerebral symptoms (visual disturbances, psychoses)	7	6.1
Night sweats	6	5.2
Swelling of face and neck	5	4.2
Dysphagia	4	3.4
Abdominal pain	4	3.4
Ankle edema	4	3.4
Clubbing of fingers	2	1.7
Unilateral sweating	1	0.87
Cyanosis	1	0.87
Uncontrolled hiccoughs	1	0.87

normal in pulmonary conditions, a change in the character or frequency of cough may be of vital importance. It can not be emphasized too strongly that the more of these symptoms the patient presents, the more likely is the tumor to be far advanced and the less likely its successful removal. In the early stages of the disease, the symptoms are few and difficult of interpretation. This, therefore, places a grave responsibility on the physician, who must consider the possibility of bronchiogenic carcinoma when the patient presents only slight cough and mild or occasional blood-tinged sputum. Valuable time (and therefore the patient's life) may be lost in waiting to see if the patient develops pulmonary tuberculosis or bronchiectasis. This is particularly true in males. In this series, the average duration of symptoms was 7.7 months, with a maximum of 48 months and a minimum of 3 weeks. The average delay of nearly 8 months is much too long and accounts for the large number

of hopeless cases who present themselves for treatment. A patient who early presents striking symptoms of a newly acquired persistent cough and hemoptysis to an alert physician is most likely to have a successful outcome in the treatment of his cancer. If the tumor develops in a small peripheral bronchus, few symptoms may be exhibited until the tumor has invaded the pleura, the regional lymph nodes and perhaps also the chest wall.

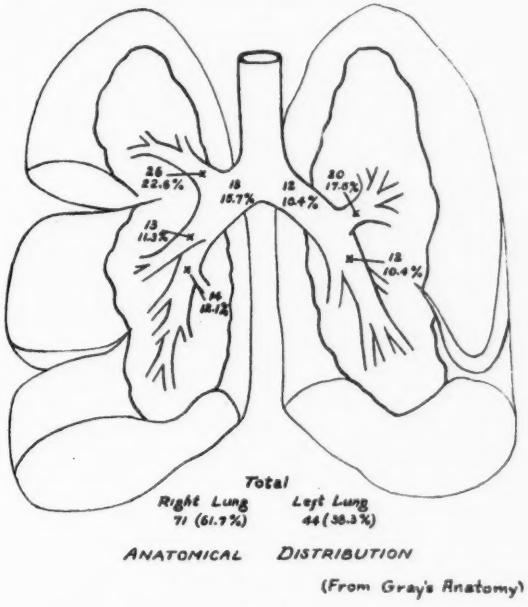


Fig. 2

The marked weight loss, and the high percentage of patients reporting it, has been a subject for discussion by numerous authors. It may be partially accounted for by persistent cough with loss of appetite and often frequent vomiting associated with paroxysms of coughing. Many patients promptly regain the lost weight following pneumonectomy with removal of the tumor and the infected lung surrounding it. This is one of the arguments in favor of palliative pulmonary resection.

Distribution of Tumors. The point of origin of the tumors is shown on Figure 2 and Table III. This information was obtained by preoperative studies and by pathologic examination of the excised lungs when resection was done, plus clinical and autopsy studies on unoperated patients.

TABLE III

DISTRIBUTION OF TUMOR
(Point of origin in bronchus)

RIGHT LUNG			LEFT LUNG		
	Number	*Percentage*		*Number*	*Percentage*
Main Stem Bronchus	18	15.7	Main Stem Bronchus	12	10.4
Upper Lobe	26	22.6	Upper Lobe	20	17.5
Middle Lobe	13	11.3			
Lower Lobe	14	12.1	Lower Lobe	12	10.4
Total	71	61.7	Total	44	38.3

Ochsner[1] reports 59 per cent of tumors in the right lung with 23.2 per cent in the upper lobe, 25.6 per cent in the lower lobe and 1.5 per cent in the middle lobe. On the left side there were 41 per cent, with 23.2 per cent in the upper lobe, 12.4 per cent in the lower lobe and .77 per cent in the lingula.

DIAGNOSIS

Roentgenology. In the 8 year period a positive or presumptive diagnosis of bronchiogenic carcinoma was made by x-ray alone in 50.4 per cent of the 115 cases. In the remaining 49.6 per cent of cases, the possibility of bronchiogenic carcinoma was not even suggested. In these cases the x-ray diagnoses included tuberculosis, atelectasis, lung abscess, cystic disease, fungus infection, pleural fluid, etc.

The fact that bronchiogenic carcinoma was suggested in only 50 per cent of cases indicates that there is no characteristic x-ray picture of bronchiogenic carcinoma. Usually the shadow seen in the x-ray is not that of the tumor, but represents the effects of the tumor, such as atelectasis, pneumonitis and abscess. The x-ray diagnosis of atelectasis, lung abscess or pleural fluid is usually correct, but carcinoma could often have been suggested as the possible cause of the changes reported.

Bronchoscopy. A bronchoscopic examination should always be done unless there is valid contraindication. Most clinics report positive bronchoscopic biopsy in from 40 to 70 per cent of cases. Whether a positive biopsy is obtained depends upon the skill of the bronchoscopist and the size and location of the tumor. Tumors not in the main stem bronchi can often be detected by the use of careful cytologic studies on bronchial washings. In this series, positive bronchoscopic biopsies were obtained in 42.6 per cent of cases. Bronchoscopy may show deformity or fixation of a bronchus but

neither of these findings is necessarily indicative of tumor, since these changes can occur in inflammatory states. Bronchoscopy is not indicated in far advanced cases when the diagnosis can readily be made from accessible lymph nodes or by aspiration of the pleural fluid. Cytologic studies on fresh sputum may be adequate to establish the diagnosis without bronchoscopy.

Bronchograms have been suggested to delineate partial or complete bronchial obstruction in bronchi too small to be investigated thoroughly through the bronchoscope. This has not been a useful procedure in our hands. When all the other diagnostic means have been exhausted, it is usually preferable to explore the patient, since injection of iodized oil will probably present an inconclusive picture and cause delay of operation until such time as the patient has evacuated most of the oil.

Other Diagnostic Means

Diagnosis may often be made by aspiration of tumor cells from pleural fluid, or even from the lung itself. Aspiration biopsy from the lung should never be done if there is any possibility of a successful resection of the tumor. If the pathologic picture should happen to be due to tuberculosis or some other infection, the aspiration may well infect the pleura and produce new complications. Peripheral lymph node biopsies (axillary, cervical, etc.) were positive in 13.9 per cent of cases. Other positive biopsies were obtained from ribs, chest wall, pleural fluid and a few lung aspirations.

Place of Exploratory Thoracotomy

Even with the above diagnostic methods, there will be a few cases in which the diagnosis cannot be made without exploration. In our series of 23 cases which were explored, no patient died as a result of operation. Usually patients who are explored for possible carcinoma of the lung will present, even if carcinoma is not found, an extensive area of pulmonary suppuration which itself requires resection. Therefore thoracic exploration for carcinoma is rarely entirely barren of favorable results and should be performed as readily as abdominal exploration.

Results. Of the 115 cases, 64 were judged to be inoperable on admission. Operation was not advised in patients who were too ill, who had tumor cells in the pleural fluid, paralysis of the diaphragm, recurrent laryngeal nerve paralysis, superior mediastinal syndrome or distant metastases. This inoperability rate of 55.6 per cent is much higher than that of 30 per cent reported by Ochsner, and in other series. Fifty-one cases were considered operable. Nine pa-

tients refused operations. Of the remaining 42 cases, 23 cases were explored and found to be non-resectable. These, with the 64 cases originally judged inoperable, reach a total of 87 hopeless patients out of 106. (Patients who refused operation are excluded from the computation.) Nineteen of the total 115 cases (16.5 per cent) were suitable for pneumonectomy. This discouraging percentage may be considered as at least in part due to the rural source of the material. Of the 64 inoperable cases, 6 could not be followed; of the 23 non-resectable cases, 3 were untraced, and of those 9 patients who refused operation, the outcome in 3 cases is unknown. All of the patients who underwent pneumonectomy were followed to date.

A study of the time of death after diagnosis indicates that of the 58 patients who were operable and could be followed, 45 (77.6 per cent) were dead in 4 months and 56 (96.5 per cent) were dead in 12 months (Table IV). Of these 22 died in less than a month after admission, most of them in the hospital. All but 2 of the 58 patients were dead in 10 months or less. One lived 14 months and another lived 24 months. In the latter 2 cases, operation might have prolonged their lives, but it was decided against because of the presence of metastases. In view of the high mortality in those traced it is presumed that most, if not all, of the untraced patients are dead. Of the 23 patients who were found on exploration to be inoperable, none died as a result of the operation and only one succumbed in the hospital. Of the 20 cases followed, 13 (65 per cent) died in 6 months or less and 18 patients were dead at the end of one year.

In the group of 19 patients who underwent pneumonectomy, there were 6 operative deaths, a mortality of 31.6 per cent. Two other patients died in 5 months or less, 2 lived 1 year, and 2 lived 2 years. The time of observation of the 7 patients alive without evidence of disease is shown in Table V. In view of the experience in other groups some of this surviving group will probably be lost to the disease. However, 4 patients alive and apparently well from 2 to 4 years after operation are a small but important group of 115 patients with a 100 per cent fatal disease.

The problem arises of palliative pneumonectomy for lung cancer. No one seriously questions the advisability of palliative operations in carcinoma of the breast, gastro-intestinal tract, or various other areas. In carcinoma of the lung, if patients can be saved the devastating effects of extensive pulmonary suppuration with attendant fever, cachexia, severe cough and foul expectoration, resection of the involved lung seems not too great a price to pay.

The percentage of apparently operable cases is low as in other series, because of long delay in observing clear-cut symptoms. Many

TABLE IV

NUMBER OF KNOWN DEATHS BY INTERVALS AFTER DATE OF DIAGNOSIS—115 CASES

	Interval in months														
	Post-op. Deaths	1 mo.	2 mo.	3 mo.	4 mo.	5 mo.	6 mo.	10 mo.	12 mo.	14 mo.	24 mo.	*Later Deaths*	*Alive*	*Not Followed*	*Total*
Inoperable		22	8	9	6		7	4		1	1	0		6	64
Exploration: Non-Resectable	1*	2	2	2	3	1	2	2	3	1	1	0		3	23
Resected: Pneumonectomy	6		1			1			2		2	0	7		19
Refused operation but apparently operable		1		2	1		1						1	3	9

DEATHS IN HOSPITAL

1. Inoperable: 18 in 64 cases—28.1%
2. Exploration: 1 in 23 cases—4.3%
3. Resection: 6 in 19 cases—31.6%
4. Refused operation: 0 in 9 cases

DEATHS IN 1 TO 12 MONTHS

1. Inoperable: 56 in 58 cases (6 not traced)—96.5%
2. Exploration: 18 in 20 cases (3 not traced)—90%
3. Resection: 10 in 19 cases—52.6%
4. Refused operation: 5 in 6 cases (3 not traced)—83.3%

*This death occurred in the hospital on the 28th day. There were no post-exploratory complications and the death is ascribed to progress of the disease rather than to operation.

TABLE V

Time of Observation	*Number of Patients*
3 months	1
6 months	1
1 year	1
2 years	1
3 years	2
4 years	1
Total Cases	7

of the patients who were admitted with evidence of far advanced tumors had been under their physicians' care for months.

Of the 115 cases, 64 were too ill or too far advanced to consider operation. Almost three fourths (70.3 per cent) of these were dead in less than 4 months. Forty-two patients were considered for operation, but in only 19 of the original 115 patients could a pneumonectomy be done. It is little wonder that the surviving group (7 patients) is so small.

Every published series of cases of bronchiogenic carcinoma emphasizes certain considerations concerning the problem which can be briefly listed.

(1) The clinical incidence of carcinoma of the lung is increasing.

(2) Because of (a) the insidious nature of the symptoms in many cases, and (b) the lack of alertness on the part of the physician, cases of carcinoma of the lung are reaching the thoracic surgeon at discouragingly late stages of the disease.

(3) Since the disease is uniformly fatal, even a few cured cases justify exploration whenever possible if carcinoma is suspected.

The present report confirms these considerations.

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HYPERPARATHYROIDISM

A Report of Eight Cases of Adenoma and One Case of Hyperplasia of the Parathyroid Gland

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Our knowledge of hyperparathyroidism covers a relatively short span of time. The first clinical observation of adenoma of the parathyroid was made in 1903, and it was as recently as 1925 that Mandl first successfully removed an adenoma. Since that time, 336 cases of adenoma, observed either at autopsy or at operation, have been reported in the medical literature. These are summarized in Norris'[1] comprehensive review, in which he tabulated all cases of adenoma that had been reported up to 1946. Norris made a plea for the reporting of additional cases by others, in the hope that some further resolution of the problems of parathyroid disease might be accomplished. It is with this thought that the present relatively small series of cases is placed on record. In the accumulated literature on the parathyroid gland, many aspects of its physiology and pathology have been considered in detail and will not be discussed here.

The diagnostic features of hyperparathyroidism have been classified as follows:[2]

1. Symptomatology: The symptoms may be classified as musculoskeletal, gastro-intestinal, urinary and miscellaneous. These appear in varying degrees in different cases. Musculoskeletal symptoms include pain in the back, deformities, fractures, difficult gait and muscular weakness. Among the gastro-intestinal symptoms are, polydipsia, colic, nausea and vomiting, and epigastric pain. Polyuria, renal colic and the passage of calculi comprise the urinary symptoms. Finally there may be weight loss, deafness and paresthesia.

2. Physical Findings: The physical findings encountered in hyperparathyroidism are varied; however, none seem to be characteristic or pathognomonic of the condition. A mass may be present in the neck. Fracture and other deformities of the bones and hypotonicity of muscles and ligaments may be observed.

3. Hypercalcemia: In typical cases the serum calcium concentration is elevated. The level varies from 12.5 to 29.4 mg. per 100 c.c.,

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but values exceeding 20 mg. per 100 c.c. are rarely encountered. In any one case individual readings may be normal, but repeated determinations will usually reveal abnormally high values.

4. Hypophosphatemia: Serum inorganic phosphorus concentrations are characteristically low, varying from 1 to 2.5 mg. per 100 c.c. In cases of far advanced renal insufficiency, these values may be normal or even elevated.

5. Increased Phosphatase Activity: Alkaline phosphatase activity is characteristically increased to a level of from 6.5 to 26 Bodansky units.

6. Hypercalcinuria and Hyperphosphaturia: The output of calcium and phosphorus in the urine may equal 70 to 90 per cent of the oral intake of these elements or it may exceed the intake when the latter is kept at the low levels of 0.1 Gm. of calcium and 0.4 Gm. of phosphorus per day.

7. X-ray examination of the skeletal system usually shows changes from spotty or diffuse decalcification and osteoporosis of the bones to the true cyst formation of classical osteitis fibrosa cystica. The long bones are affected most frequently and the vertebrae, sacrum, pelvis, skull, jaw bones, flat bones of the thorax and tubular bones of hands and feet show changes in a direct order of frequency.

8. Renal Calculi: Calcification in the urinary system may appear in various forms: (a) calculi in the renal pelvis; (b) spotty calcification in the uriniferous tubules; and (c) calcification of renal tissue. The last is regarded as a part of the process of precipitation of calcium phosphate in other soft tissues.

The cases herein reported were admitted to the University of Virginia Hospital between the years 1934 and 1948. They fall into two general groups: (1) Those that had gross evidence at operation of a parathyroid adenoma with microscopic confirmation; and (2) Those that had diffuse parathyroid hyperplasia, also proved microscopically, with hyperparathyroidism. There were 8 patients in the first category and one patient in the second.

The significant findings in these 9 cases are summarized in Table I. The ages ranged from 19 to 72 years. There were 5 males and 4 females. In one instance, the lesion was situated in the region between the suprahyoid and the base of the tongue; in another it was retropharyngeal and in a third, mediastinal. In the remainder, it occupied one of the usual positions of a parathyroid gland. No patient had multiple tumors. Of the 9 cases, 6 showed skeletal changes on x-ray and 3 did not. Of the 3 which did not show skeletal changes, one had renal calcification or stones. There were only 2

TABLE I. CASES WITH ADENOMA OR HYPERPLASIA OF PARATHYROID

No.	Age Yrs.	Sex	Nodule Neck	Location Tumor	Measurement Tumor in Cm.	Weight in Gm.	Skeletal Changes	Renal Stones and/or Calcification	Blood Calcium Mg./100 c.c.	Blood Phosphorus Mg./100 c.c.	Remarks
1	19	F		Retro-Esophageal	2 x 1 x .7	*	Yes	No	11-13.8	1.5-2.2	
2	34	M		Left lower pole	1.8 x .8 x .6	*	No	Yes	13.5	2.4	
3	50	M		Left lower pole	1.5 x .5	*	No	No	11-12.9	2.4-2.9	
4	22	M	Yes	Left neck	3.6 x 4.8 x 6.5	52	Yes	No	10-12	3.2-4.5	
5	35	F		Left lower pole	3.0 x 2.5 x 2.0	*	Yes	No	13.8-16.8	2.76-3.4	Postop. Tetany Blood Ca. 5.5
6	48	F	Yes	Left lower pole	2 x 2 x 1	4	Yes	Yes	15.4-15.9	3.6-4.9	
7	72	M	Yes	Suprahyoid and base of tongue	1 x 1.5 x .5 6 x 4 x 3	*	No	No	***	***	Preop. Diag. Cyst of Tongue and Neck
8	58	M		Superior Mediastinum	3.5 x 1.5 x 1.5	11	Yes	Yes	15.4	3.8	
9	50	F		Posterior to left lobe	3.5 x 1.5 x 1**	*	Yes	No	12.6-13.6	1.8-2	Hyperplasia Diffuse Type of One Gland

*Not recorded. **Size of Tissue removed. ***Not obtained prior to operation (seetext).

cases among the 9 which did not show either skeletal changes on x-ray or renal calcification or stones.

The figures for blood calcium are interesting. The lowest finding was 10 mg. per 100 c.c. and the highest 16.8 mg. per 100 c.c. If one considers only the highest blood calcium determination in each case, it will be noted that not one showed a maximum finding of less than 12. Three cases showed palpable nodules or masses in the neck which proved to be adenomatous parathyroid glands. In one, a poor operative risk, a small incision was made and the adenoma was removed without additional exploration. The preoperative diagnosis had been definite, and the postoperative result was highly satisfactory. The largest gland of the series measured 3.6 by 4.8 by 6.5 cm. and weighed 52 Gm. Microscopic examination showed it to be a chief cell adenoma.

One case (No. 7) deserves particular comment. A 72 year old white man entered the hospital with a complaint of pain and swelling in the floor of the mouth for 5 months. There had been no complaints associated with the musculoskeletal or urinary systems. Examination revealed a rounded, fluctuant mass the size of an "orange," palpable above the hyoid bone externally, and in the floor of the mouth and posterior part of the base of the tongue internally. There was a mild anemia. Urinalysis showed 20 white blood cells per high power field in a centrifuged specimen, and a maximum specific gravity of 1.027. Phenosulphonthalein excretion was 35 per cent in 2 hours.

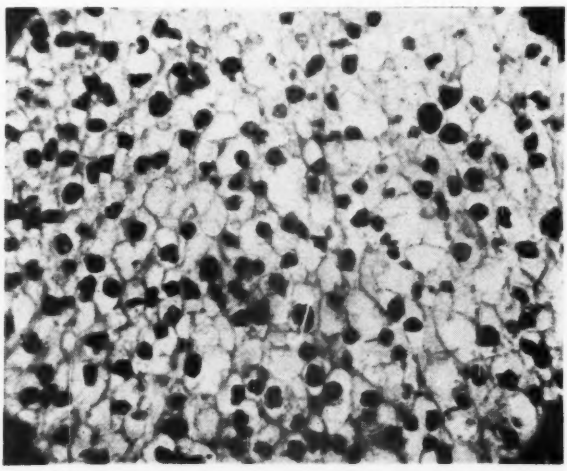

Fig. 1. Photomicrograph of a Parathyroid Adenoma (x500). Case No. 7.

A preoperative diagnosis of cystic lesion of the neck, probably neoplastic, was made and an operation performed. Through a transverse suprahyoid incision

the cyst was entered inadvertently. Bloody fluid and material resembling tuberculous granulation tissue was evacuated. Complete removal of the mass required dissection to the base of the tongue near the foramen cecum. On pathologic study, a parathyroid adenoma was identified (fig. 1). It measured 3 by 4 by 6 cm. in size. Because the true nature of the mass had not been suspected before operation, blood chemistry studies were not obtained prior to removal of the tumor. Postoperative x-rays of the skull, hands, spine and pelvis were negative.

As stated above, there was one instance of clinical hyperparathyroidism, in which true hyperplasia occurred in one gland.

A 50 year old white female (Case 9) had been weak and bedridden for 3 years. No bony deformity was present. There were nocturia and polyuria. Physical examination showed only malnutrition. Blood calcium ranged from 12.6 to 13.6 mg. per 100 c.c. Blood phosphorus was 1.8, and 2.0 mg. per 100 c.c., and alkaline phosphatase 32.4 Bodansky units. X-ray of the skull showed moderate diffuse decalcification with many minute cysts. On exploration of the neck a large parathyroid gland was found between the thyroid and the trachea on the left, probably representing the lower gland on that side. It measured 1.0 by 1.5 by 3.0 cm. Microscopic section showed diffuse hyperplasia of the gland. Following operation the patient was greatly improved, and the blood calcium and phosphorus values became essentially normal.

Follow-up of the 9 patients herein reported has not been complete in all details. By means of a combination of visits to the Out-Patient Department and a written questionnaire, later information concerning almost all of these patients has been obtained (Table II). Of the 8 patients in whom an adenoma was found, 2 (Cases 1 and 7) have had excellent results. Two (Cases 2 and 5) have had results which could be called good, but which have been marred in some way by some minor condition associated with hyperparathyroidism. One patient (Case 8) reported relatively severe tetany characterized by convulsions beginning 62 days after operation and gradually improving with conservative therapy; and one patient (Case 6) died from cause unknown approximately one year after operation. One patient (Case 4) could not be contacted. Case 3 had a poor result because of the continuation of symptoms noticed preoperatively. The patient with hyperplasia reports a good result from operation.

Summary and Conclusions

1. Eight cases of adenoma and one case of diffuse hyperplasia of the parathyroid gland are added to the literature. These cover the experience at the University of Virginia Hospital between the years 1934 and 1948.

2. The clinical and diagnostic features of hyperparathyroidism are briefly reviewed.

TABLE II. FOLLOW-UP STUDY — CASES IN WHOM ADENOMATOUS OR HYPERPLASTIC PARATHYROID GLANDS WERE REMOVED

No.	Pathologic Diagnosis	Length of Follow-up	Return of Symptoms of and Those Associated with Hyperparathyroidism	Unassociated Conditions Complicating Post-operative Period	Result
1	Adenoma	14 yrs.	None	None	Excellent
2	Adenoma	14 yrs.	One stone passed 10 yrs. ago	Cerebrovascular accident 12 yrs. ago; recovery complete	Good
3	Adenoma	14 yrs.	Urinary calculi; Weakness	Died 3 yrs. postoperative, cause unknown	Poor
4	Adenoma	No Follow-Up			
5	Adenoma	12 yrs.	Increased Kyphosis with nerve root pain	Hypertensive vascular disease	Good
6	Adenoma	Died 1 yr. postoperative; cause unknown			
7	Ademona	3 yrs.	None	Benign prostatic hypertrophy	Excellent
8	Adenoma	9 mos.	Postoperative tetany began 62 days post-operative; one fracture with trauma	None	Fair
9	Diffuse Hyperplasia	9 yrs.	None	Arthritis	Good

3. The anatomic and diagnostic features of these 9 cases are recorded in tabular form, and unusual cases reported in some detail.

4. Follow-up studies of 9 cases are evaluated. There is only one case in which the result of operation is considered poor. In all other cases followed, operative removal of the offending gland was helpful to the patient in varying degrees.

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RADIAL NERVE DIVISION

Report of 88 Cases

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PERIPHERAL nerve lesions are relatively infrequent in civilian practice, but comprise a large percentage of the cases on neurosurgical services in general army hospitals in time of war. The present group of 88 cases observed in a military hospital had complete severance of the radial nerve in the upper arm, in which end-to-end suture was carried out. The period of postoperative follow-up varies from 3 to 21 months.

The radial nerve is the direct continuation of the posterior cord of the brachial plexus, which is formed by the union of the three posterior divisions of the three trunks of the brachial plexus. It commences at the junction of the middle and outer thirds of the clavicle at the lower border of the pectoralis minor muscle, and passes downward and lateralward in the axillary fossa behind the third part of the axillary artery. From the lower border of the axillary fossa it descends into the arm, where at first it lies on the medial side of the upper third of the humerus behind the brachial artery and in front of the long head of the triceps muscle. Its course is then obliquely downward and lateralward behind the middle third of the humerus in the groove for the radial nerve, where it passes between the medial and lateral heads of the triceps muscle. At the junction of the middle and lower thirds of the humerus it reaches the lateral aspect of the arm and, after piercing the lateral intramuscular septum, runs downward and forward between the brachioradialis and brachialis muscles. At the elbow the nerve divides into two branches, the deep muscular and the superficial sensory.

The cases reported all had a complete severance of the radial nerve at some point between the lateral border of the pectoralis minor muscle and the elbow. Each case had a complete and careful preoperative evaluation including electrical studies. A record was kept of the four factors by which the results of nerve suture might be influenced: namely, (1) the degree of soft tissue injury, (2) the presence or absence of fracture, (3) the time interval between injury and nerve suture, and (4) the length of the defect between the nerve ends before suture.

Treatment. The exposure of the nerve varied with the level of the lesion. In general those cases which had a lesion above the medial and lateral heads of the triceps were exposed by an incision over the anteromedial aspect of the arm, while those with lesions

below the short heads of the triceps muscle were exposed through an incision over the course of the nerve on the posterolateral aspect of the lower half of the upper arm. It was found necessary at times to make a combined exposure of the nerve on the posterior and anterior aspects of the arm. Every effort was made to gain a satisfactory anastomosis under minimal tension with nerve ends which were grossly free of scar. End-to-end suture was carried out in each case using fine silk or tantalum wire. Four methods were used to obtain nerve length so that a satisfactory suture could be carried out: (1) extensive mobilization of the nerve, (2) flexion of the elbow, (3) abduction of the shoulder, and (4) in several cases transplantation of the nerve anterior to the humerus. Immobilization of the extremity was maintained for 3 weeks postoperatively by plaster or other suitable dressing and was followed by a program of intensive physiotherapy including electrical stimulation.

Postoperative Evaluation. Each patient was evaluated at 3 month intervals in regard to progress. The degree of motor recovery was recorded as Grade 0 to 4. A recovery of Grade 0 indicated no recovery; Grade 1, perceptible contraction in proximal muscles; Grade 2, return of proximal muscles and distal muscles to such an extent that sufficient motor power was present to act against resistance; Grade 3, the return of synergetic and isolated movements; and Grade 4, complete recovery of motor function. The sensory changes following injury to the radial nerve are so variable that they were not considered of great importance in the evaluation of recovery.

The analysis of this group of cases was undertaken primarily to determine two factors. First, it was important to know how soon after suture recovery of function could be expected so that a secondary operative procedure, either re-exploration of the nerve or tendon transplantation, could be carried out as soon as it was clear that the primary procedure would not result in a satisfactory functional result. Second, it was important to determine if collateral factors such as fracture, the time interval between injury and suture, and the length of the defect in the nerve before suture affected the prognosis for recovery and the speed of recovery so that these factors could be considered in the decision as to a secondary procedure in individual cases. The degree and percentage of recovery in the group as a whole was of secondary importance to these other facts at the beginning of the study.

The cases were grouped for analysis according to their degree of recovery. Each of the recovery groups was then arranged according to the time interval of observation in an effort to determine how

soon recovery could be expected. The cases were also classified with respect to the degree of recovery and the presence or absence of the factors thought to influence recovery: namely, associated fracture, time interval between injury and suture, and defect in the nerve before suture.

TABLE I

TIME INTERVAL SINCE SUTURE AND DEGREE OF RECOVERY

Months	0 Recovery	1 Recovery	2 Recovery	3 Recovery	4 Recovery
3	4				
4	3	2			
5	2	1	1		
6	1	1	8		
7	1	2	9	2	
8	1	2	7	4	
9		4	2	3	
10		1	3	3	1
11		1	1	4	2
12	2	1	2	1	
13	1	1		1	
14			1		1
16					
21				1	
Total Cases	15	16	34	19	4

In Table I the cases are grouped according to the length of observation following suture and the degree of recovery. There were 15 cases which showed no recovery, but only 3 of these cases were followed for a period after suture greater than 8 months. There were 16 cases which showed a recovery of Grade 1, ranging from 4 months to 14 months after suture. The majority in this group were observed between 6 and 10 months. There were 34 cases which showed a recovery of Grade 2 following observation of from 5 to 14 months after suture. Here the majority of cases fell between the 6 and 10 month periods of observation. There were 19 cases which showed Grade 3 recovery after an interval of from 7 to 13 months. The majority in this group were observed between 8 and 12 months. There were only 4 patients who showed complete recovery; but it must be remembered that due to the criteria for classification all cases with Grades 3 and 4 recovery represented functionally satisfactory results. From the analysis of the degree of recovery as compared to the interval following suture, without consideration of collateral factors, it is obvious that in general no important degree of recovery can be expected following suture until

after an interval of at least 6 months and that recovery following this interval will be progressive over a period of approximately one year or longer. There were only 3 cases followed for a sufficient period in which recovery was not obtained and could not be expected. Two of these 3 cases were followed for 12 months and one for 13 months. In each when considered individually it was found that there were collateral factors which would be expected to influence the prognosis, such as scarring of the nerve grossly at the time of suture, excessive tension or associated bone injury.

TABLE II

INCIDENCE OF FRACTURE AND AVERAGE DEFECTS AFTER SURGERY IN RECOVERY GROUPS

Recovery Group	0 Recovery	1 Recovery	2 Recovery	3 Recovery	4 Recovery
Per cent associated fracture 86 cases	80%	66%	50%	35%	0%
Average defect before suture 67 cases	5.3 cm.	5.2 cm.	4.0 cm.	3 cm.	2 cm.

In Table II the cases having an associated fracture and the average defect after freshening of the nerve ends have been classified as to degree of recovery. The percentage of fractures varied inversely with the degree of recovery. In the group that showed no recovery, 80 per cent were associated with fracture whereas in the most complete recoveries none was associated with fracture. Similarly the length of the defect was related to the degree of recovery. The average defect in the group with no recovery of function was 5.3 cm. and in the group showing complete recovery the average defect was only 2 cm. This suggests that the patient with an associated fracture and with a large defect between the nerve ends before suture presents a poorer prognosis for recovery than the patient in whom fracture is not present and the defect is minimal.

In Table III the intervals of time between injury and suture are compared with the degree of recovery. The majority of the cases were sutured in the 1 to 6 months' period following injury, but there is apparently no interval up to one year in which regeneration and functional recovery cannot be expected to take place.

TABLE III

INTERVAL BETWEEN INJURY AND SUTURE IN VARIOUS RECOVERY GROUPS

	0 Recovery	1 Recovery	2 Recovery	3 Recovery	4 Recovery	Total
Immediate sutures	0	0	0	1	1	2
Within the first month	0	0	0	2	2	4
One to three months	2	5	12	5	1	25
Three to six months	9	8	16	10	0	43
Six months to one year	3	1	5	1	0	10
Over one year	0	0	1	0	0	1
Unknown	1	1	0	1	0	3

SUMMARY

From this study it is apparent that recovery following radial nerve suture is satisfactory in a high percentage of cases (Table IV). Sixty six per cent of cases showed fair recovery (Grades 2 to 4 inclusive) and 27.2 per cent showed satisfactory functional result (Grades 3 and 4). The degree of recovery is not greatly influenced by the period between injury and suture up to a maximum of one year following the injury. The presence of an associated fracture apparently influences unfavorably the prognosis for recovery. The defect between the nerve ends before suture probably influences the prognosis for recovery, although any suture under minimal tension of a nerve which is not scarred will result in satisfactory regeneration and functional recovery. The beginning of recovery following radial nerve suture cannot be expected before 6 months and thereafter the recovery can be expected to be progressive over a period of one year or longer.

TABLE IV

PERCENTAGE OF RECOVERY

Recovery Group	Total Number of Cases	Percentage of Total Cases
0	15	17.0
1	15	17.0
2	34	38.8
3	20	22.7
4	4	4.5
Total	88	100.0

INTRAPERICARDIAL FOREIGN BODIES

A Report of Two Cases

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ALTHOUGH the presence, and subsequent successful removal, of an intrapericardial foreign body is neither a rare occurrence nor an unusual accomplishment, such cases occur with sufficient infrequency to justify the adding of isolated instances to the medical literature. The purpose of this paper is to report two patients who had intrapericardial metallic foreign bodies which were successfully removed. In one the point of lodgment was in the myocardial muscle. In the other, two missiles lay within the pericardial sac adjacent to the great vessels.

CASE REPORTS

CASE 1. A 19 year old American soldier was wounded in action in Belgium on Jan. 29, 1945. He sustained multiple, serious injuries inflicted by high explosive shell fragments. His wounds were as follows: penetrating wounds of upper abdomen and liver; penetrating wounds of upper and lower sternal region with a compound comminuted fracture of the upper aspect of the gladiolus sterni; multiple penetrating wounds of the upper medial third of the right thigh, anterior lower third of the left arm, lateral lower third of the left forearm all with retained foreign bodies; lacerations of the left cheek and neck. A roentgenogram obtained January 29 showed an increased pericardial shadow (fig. 1).

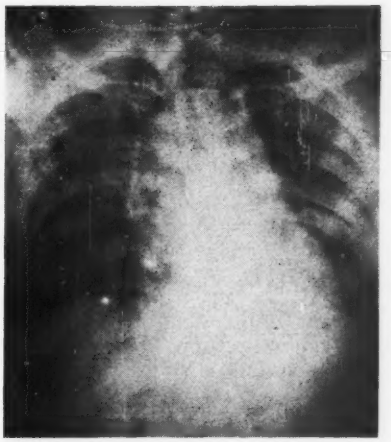

Fig. 1. Photograph of roentgenogram (anteroposterior view) taken the day of wounding showing pericardial effusion. No foreign body is apparent. (Case 1.)

The patient was operated upon on January 30 in a field hospital. Explorations of the abdominal cavity and anterior mediastinum were performed and the wounds of the lower chest and neck were debrided. During the postoperative period two pericardial aspirations were necessary for hemopericardium. One was done on February 13 and 110 c.c. of bloody fluid were obtained, the other on February 15 at which time 50 c.c. of bloody fluid were obtained. There was no evidence of tamponade. An electrocardiogram is recorded as showing changes consistent with pericardial effusion. A roentgenogram obtained February 22 showed a large pericardial shadow (fig. 2).

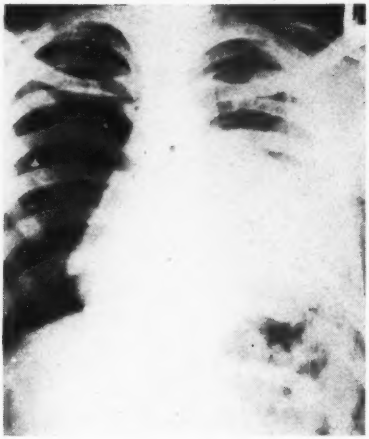

Fig. 2. Photograph of roentgenogram (anteroposterior view) taken 24 days after wounding showing large pericardial shadow. No foreign body is apparent. Figures 1 and 2 illustrate the importance of heavy exposure of the film in the search for intrathoracic foreign bodies. (Case 1.)

On March 12 he was admitted to a thoracic surgery center in the Communications Zone for definitive treatment. By this time all of his wounds had healed and the finding of significance was the presence of two retained foreign bodies in the thorax which could not be disassociated from the pericardial shadow on fluoroscopic examination. This was confirmed by roentgenograms (fig. 3). Preoperative electrocardiogram was obtained, but the tracings and report are lost.

The patient was operated upon on March 20 under endotracheal gas-oxygen-ether anesthesia. A left hockey stick incision was used to expose the pericardium. The incision was started in the second interspace and extended downward along the left border of the sternum to the fourth interspace into which it was extended laterally several centimeters to the left of the nipple. Sections of the left third and fourth costal cartilages were resected and the fifth divided. The left internal mammary vessels were ligated and divided. The pericardial sac was opened by a trap door type of incision with the base parallel to the phrenic nerve. The pericardial cavity was obliterated by adhesions. There were two irregularly-shaped metallic shell fragments (fig. 4) both within the pericardium, one was on the right (1.2 by .5 by .7 cm.) situ-

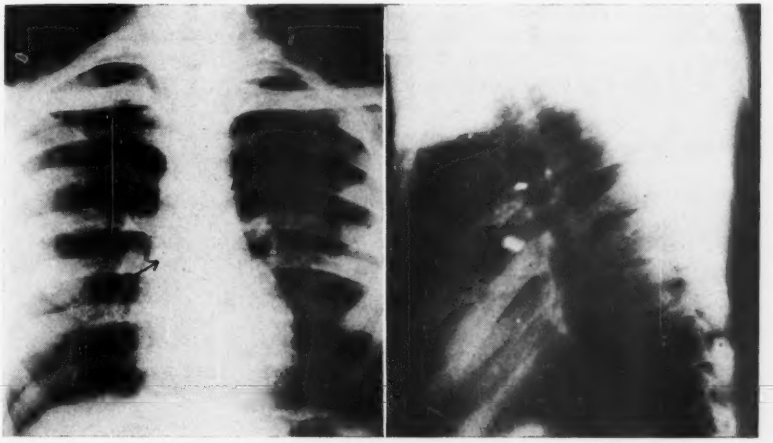

Fig. 3. Photographs of roentgenograms (anteroposterior and lateral views) showing 2 radiopaque foreign bodes superimposed on the cardiac shadow. (Case 1.)

ated on the arch of the aorta, but not within it and lying between this structure and the superior vena cava. The other (.6 by .7 by .4 cm.) was wedged between the left pulmonary artery and the aorta. The foreign bodies disclosed were removed, first the one on the left then the one on the right. The edges of the pericardium were loosely approximated. A catheter was placed within the left pleural cavity. The thoracic wound was closed in layers using interrupted cotton sutures. During the course of the operation the patient received 1,000 c.c. of whole blood and 500 c.c. of plasma.

Postoperatively the patient developed pericardial effusion, but no tamponade, and the effusion gradually resorbed. Seven days after operation an electro-

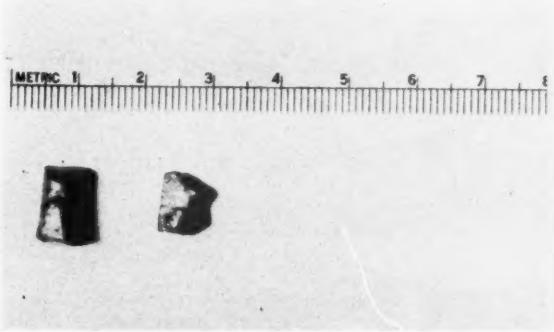

Fig. 4. Photograph (actual size) of replicas of metallic foreign bodies removed from the pericardial sac. (Case 1.)

cardiogram was interpreted by a consultant in cardiology as showing changes compatible with residual pericarditis. The pericarditis gradually cleared. A roentgenogram of May 1 (fig. 5) showed an essentially normal pericardial shadow which was, of course, free from foreign bodies.

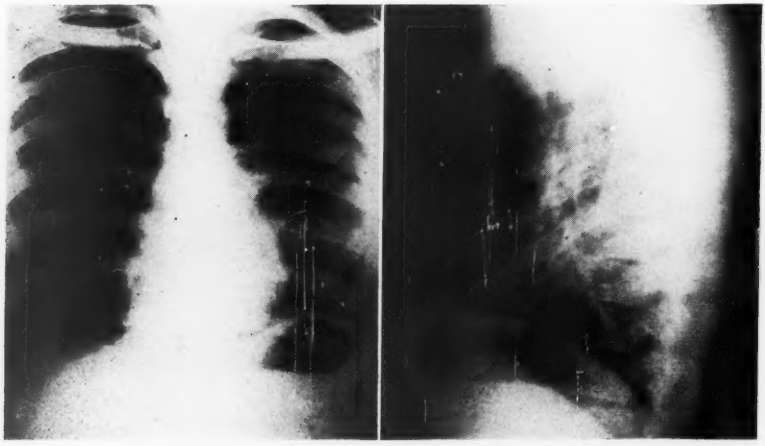

Fig. 5. Photographs of roentgenograms (anteroposterior and lateral views) taken approximately 4 months following operation. The pericardial effusion has cleared and no foreign bodies are present. (Case 1.)

On June 20 the patient was evacuated to the Zone of the Interior, where he was admitted to a general hospital. An entry was made on the record to the effect that the pericarditis was improved. A metallic foreign body was removed from the left forearm and a cicatrix involving the face and neck was excised. He was separated from the service Oct. 19, 1945. A letter written in January, 1948, in response to an inquiry indicates that his condition is good save for exertional dyspnea, occasional chest pain and numbness in the region of the chest incision.

CASE 2. A 26 year old American soldier was wounded on April 3, 1945, in Germany while engaged in combat. A shell fragment penetrated the left chest entering the second interspace one inch to the left of the anterior axillary fold. It traversed the soft tissues of the left chest and lodged in the position to be described later. On the day following injury debridement was carried out in the forward area at an evacuation hospital. At the time of initial operation a catheter was inserted into the left thorax and brought out through the left seventh interspace. Closed drainage was maintained for 5 days at the end of which time the catheter was removed and the patient evacuated to a general hospital in the Communications Zone. At the latter hospital on April 11, 60 c.c. of blood were aspirated from the left chest. He was evacuated to another general hospital where a thoracentesis failed to yield fluid.

The patient was then transferred to a thoracic surgery center to which he was admitted on April 27 in good condition. The left chest moved poorly on

respiration and breath sounds at the left base were diminished, the wound of entry was healed, and the heart was negative. Fluoroscopic examination revealed an opaque foreign body superimposed on the cardiac shadow. When the patient was rotated, the foreign body could not be dissociated from cardiac shadow. The lower end of the foreign body moved with cardiac pulsations, but the upper end showed no motion. There was no movement of the foreign body on respiration. From these findings it was postulated that one end of the foreign body was attached to the heart and from the relation of the foreign body to the cardiac shadow that the point of attachment was probably the right auricle. A roentgenogram (fig. 6) obtained on April 27 confirmed the presence of the foreign body. An electrocardiogram done the following day was interpreted as showing changes compatible with subacute pericarditis.

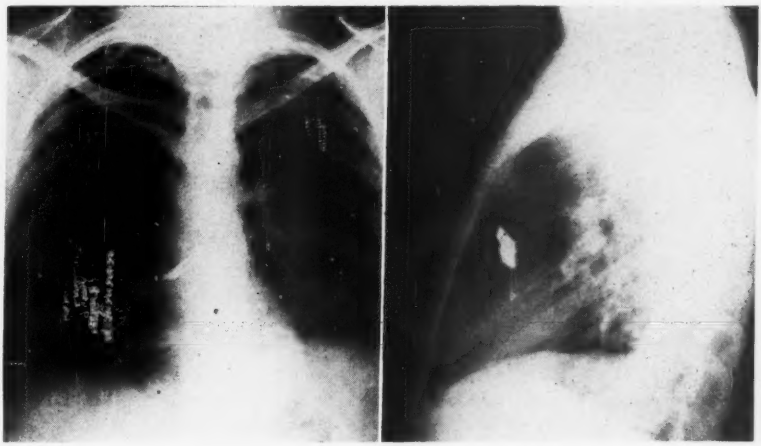

Fig. 6. Photographs of roentgenograms (anteroposterior and lateral views) showing an irregular radiopaque foreign body superimposed on the cardiac shadow. (Case 2.)

The patient was operated upon May 2 under endotracheal gas-oxygen-ether anesthesia after pentothal induction. A curved incision was started in the second interspace opposite the right border of the sternum. It was continued downward parallel to the sternal border to the level of the fourth interspace and was thence directed laterally for a distance of approximately 3 cm. beyond the right nipple. The pectoralis muscle was reflected for a short distance laterally and superiorly. The right third and fourth costal cartilages were divided and a 3 cm. segment of the second costal cartilage was resected. The pleura was opened in the third interspace after dividing and ligating the internal mammary vessels in this interspace. The fourth intercostal artery was divided 2 cm. to the right of the sternal border, and the entire muscle bundle in this region was cut across. The above approach rendered adequate exposure for the operative procedure. The right pericardium was incised starting at the root of the great vessels and continuing downward for a distance of approximately 7 cm.

The pericardial sac was obliterated by fine adhesions. There was an irregular metallic shell fragment (fig. 7) measuring 3.8 by 1.2 by .6 cm. lying within the pericardium. Approximately one half of it was embedded in the wall of

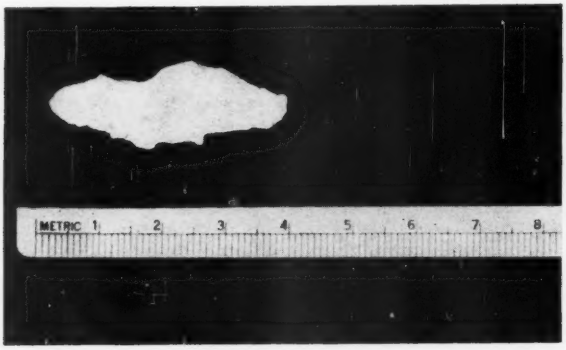

Fig. 7. Photograph (actual size) of a plaster model of the metallic foreign body removed. (Case 2.)

the right ventricle and lay between this structure and the right auricle. The remainder of the foreign body was covered with dense adhesions and lay within the pericardial sac and was attached to the anterior pericardium in the region of the root of the aorta. Surrounding the metallic shell fragment were several small pieces of brown woolen cloth.

After numerous adhesions surrounding the foreign body had been freed, several fine silk stay sutures were placed in the wall of the right ventricle, and the foreign bodies were removed. There was no evidence at the time of removal that the chamber of the ventricle or auricle had been entered; however, there was some erosion of the wall of the right ventricle in the region from which the foreign body was removed. This was covered over by tying the previously placed stay sutures and placing between them several additional fine silk sutures. The edges of the pericardium were loosely approximated with interrupted fine cotton and 100,000 units of penicillin were instilled in the pericardial sac. The thoracic wound was closed in layers using interrupted cotton suture material for the soft tissues and a single fine steel wire to approximate each of the third and fourth costal cartilages. A soft rubber catheter was placed in the thorax and the lung was expanded under positive pressure. One hundred thousand units of penicillin were instilled in the chest cavity. Throughout the procedure the pericardium was bathed frequently with a 5 per cent solution of novocaine, a total of 70 c.c. being used.

The postoperative course was entirely without mishap. The wound healed without infection. Ambulation was started on the day after operation. On May 7 an electrocardiogram showed changes consistent with residual pericarditis. A roentgenogram on May 18 showed the cardiac shadow to be normal and there was, of course, no evidence of foreign body (fig. 8). On June 4 the patient was evacuated to the Zone of the Interior, where he arrived at a thoracic surgery center June 27. He complained of dyspnea and some pain in the right chest. A roentgenogram of the chest showed the metallic suture in the soft tissues of the right anterior chest and partial obliteration of the left

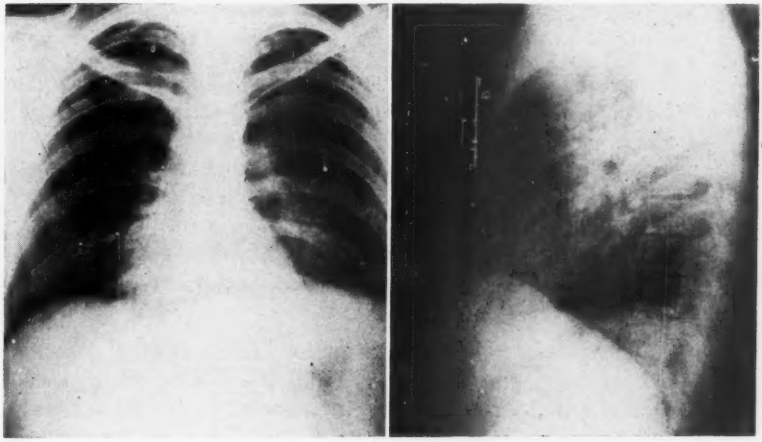

Fig. 8. Photographs of roentgenograms (anteroposterior and lateral views) showing normal cardiac shadow and no foreign body. (Case 2.)

costophrenic sulcus due to thickened pleura. An electrocardiogram was found to be within the limits of normal and a cardiac consultant found no evidence of heart disease. He was separated from the service on Aug. 15, 1945. A follow-up letter was written to the patient and his reply in January, 1948, stated that although his wound causes pain in damp, cold weather, he is progressing satisfactorily and can do any type of work which does not require heavy lifting.

Comment

It is not the purpose of this paper to review the literature on the subject of intrapericardial foreign bodies. Decker[1] collected the cases of foreign body in the heart and pericardium between the years 1900 and 1938 and found 13 instances of foreign body within the pericardial sac. In 8 cases operation for removal of the foreign body was undertaken and there were no deaths. Decker's report does not include the period of World War II during which interval a number of instances of intrapericardial foreign body are recorded.

Harken[2] has had extensive experience in the surgery of foreign bodies within and in relation to the heart and great vessels. In his article on this subject he reports having removed foreign bodies from the pericardial sac in 26 instances without mortality.

Miscall and Harrison[3] in an account of their observations in a thoracic surgery center report the removal of foreign bodies from the pericardial sac in 3 instances, from the interventricular septum in 1 and from the auricular or ventricular walls in 9. They state that obliterative pericarditis existed in every case and that a high

percentage of foreign bodies removed yielded micro-organisms on culture.

Samson[4] in recording the forward area experience of an auxiliary surgical group in World War II, reviews 75 patients with wounds involving the heart and pericardium. In this series, there were 10 instances in which a foreign body was believed to be in the myocardium and 3 in which a foreign body was believed to be within the pericardial sac. Removal of the foreign body was carried out in 3 of the former group and 1 in the latter. In addition, the removal of foreign body embedded in the pericardium was carried out in 4 patients.

Tuttle, Langston and Crowley[5] observed intrapericardial foreign body in 3 instances among 320 penetrating or perforating wounds of the thorax. In 1 of these cases the foreign body was extremely small and was left in place. In the other 2 the fragments were removed.

Watts and Toone[6,7] report the successful removal of intrapericardial foreign bodies in 3 instances. In their discussion of this topic they point out that for the most part the question of surgical intervention lies with the clinical appraisal of each individual case. The symptoms, the objective evidence of pericardial or myocardial changes and the possibility of future complications are to be balanced against the operative risk. All of their patients experienced pain, attributed to the foreign body, which disappeared when the foreign body was removed. All showed abnormal electrocardiograms. These authors comment upon the possibility of subsequent developments of serious nature if the foreign body is not removed. They state that there is always the danger of infection arising at the location of any foreign body, particularly when organic matter, such as clothing, is present with the metallic foreign body. There is also the possibility of erosion or penetration of adjacent vital structures such as the heart chambers or the great vessels.

In their experience with patients having foreign bodies within or adjacent to the heart or great vessels, Harken and Zoll[8] were impressed with the importance of cardiac neurosis as a reason for the removal of foreign bodies located in this region. This became an important consideration to these patients despite efforts to reassure them. Harken and Zoll found that all of their patients with foreign bodies in or near the heart wanted the foreign body removed.

An additional reason for the removal of intrapericardial foreign bodies, one not mentioned above, is based on the accuracy of foreign body localization. One cannot be certain that the foreign body is in the pericardial sac and not within one of the chambers of the

heart in which event the possibility of the foreign body becoming embolic is an added reason for a surgical attack on a foreign body which cannot be dissociated from the pericardial shadow on fluoroscopic examination.

In summary, there appear to be the following indications for the elective removal of foreign bodies from the pericardial sac: (1) to prevent infection, (2) to prevent injury to adjacent structures, (3) to prevent neurosis. In addition operation is indicated when a foreign body lies within the limits of the pericardial shadow on fluoroscopic examination because of the possible error in localization.

SUMMARY

1. Two cases of intrapericardial metallic foreign bodies are reported. In one, the point of lodgment was in the myocardial muscle. In the other, two missiles lay within the pericardial sac adjacent to the great vessels. In both instances the foreign bodies were successfully removed by surgical operation.

2. Indications for the removal of foreign bodies from the pericardial sac are listed.

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THE MANAGEMENT OF INCURABLE CANCER

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SURPRISINGLY enough, many physicians still hold to the attitude that when a cancer patient develops a metastasis or recurrence, the doctor's rôle from then on consists in writing prescriptions for opiates. If there ever was a time when such an attitude was justified, that day has long since passed.

WHAT IS INCURABLE CANCER?

In the first place, neither regional metastases nor local recurrences are necessarily cause for classifying the patient's disease as incurable. In comparison to such dramatic discoveries as have taken place in recent years in the field of chemotherapy with their immediate, brilliant effect on mortality statistics from infections, the gradual advances in surgical technic are not noticed. Today the surgeon does not hesitate to attack cancers which, a few years ago, would have been considered hopelessly inoperable. The effect of improved treatment on cancer mortality statistics does not appear for years, but the cumulative effect is, and will be, startling.

Fifteen years ago, the thoracic surgeon was able to offer nothing to a victim of pulmonary cancer. Then Graham and Rienhoff demonstrated the practicability of total pneumonectomy. At once, it was possible to cure pulmonary carcinoma confined to one lung. Since the mediastinal glands on one side can be completely stripped off, the disease can be cured even when metastasis has spread to the glands on the affected side, provided it has spread no further. A few patients with peripheral lesions which involve a limited portion of the adjoining chest wall or diaphragm have had successful resections plus pneumonectomy. Ochsner has pioneered in this extension of the usefulness of total pneumonectomy.

In the same way, the abdominal surgeons, following the lead of Brunschwig, now resect carcinomas invading multiple adjoining structures. For example, a patient in our Tumor Clinic has been followed for 3 years after resection of a carcinoma primary in the upper descending colon and invading the abdominal wall, tail of the pancreas, spleen, and left kidney. Because no distant metastases were found, radical operation was undertaken. The tail of the pancreas, the spleen, the left kidney, part of the descending colon, and

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the involved portion of the abdominal wall were resected, and there has been no recurrence or metastasis yet.

Neurosurgery, head and neck surgery, in fact all of the surgical fields have developed amazingly extensive procedures which enable the operator successfully to eradicate what used to be considered hopelessly extensive cancer.

X-ray therapy and radium are also used more vigorously, with success in what were once classified as incurable situations. By attempting the seemingly impossible, occasional miraculous results follow. We have in our Tumor Clinic the records on a case of Ewing's tumor, primary in a rib and showing innumerable pulmonary metastases, which cleared up completely after a course of x-ray therapy. Sixteen years later, this patient is free of recurrence or metastasis.

No previously untreated cancer patient should be considered incurable until a team composed of a competent pathologist, radiologist, and surgeon, has reviewed the case.

The Problem Faced

Yet, in spite of advances, the 5 year and longer survival rate of cancer patients remains discouragingly low. Though the figure has jumped about 10 per cent in as many years, the overall percentage of "cures" has risen only to between 20 and 25 per cent. Today about 75 per cent of our cancer patients must be handled with admittedly incurable cancer. If the knowledge we now have is applied to its best advantage, the percentage of cures can at least be doubled, but from a practical standpoint, the care of the incurable patient remains our largest, most difficult cancer problem.

Palliation Is Worthwhile

Though attempts at cure have failed, though the case must be labeled "incurable," still the physician's rôle is not reduced to writing prescriptions for opiates. By the judicious use of palliative procedures, many incurable cancers can be controlled for years. It is not a matter of prolonging the painful existence of an invalid. It is a matter of restoring an invalid to useful, happy life. There are many persons with incurable cancers carrying on their normal careers with greater ease than the average diabetic, cardiac, mental or allergic patient.

Palliative Procedures

1. *Analgesic and hypnotic drugs.* Morphine, morphine derivatives, and morphine-like drugs should be used in as small an amount

as possible to carry the patient through difficult episodes while other more lasting treatment is being planned and administered. By combining hypnotic with analgesic drugs, the dosage of the latter can be kept down. The drugs should be given by the doctor, a nurse, or a responsible member of the family, never used at the patient's discretion. Drug addiction is an undesirable complication to be avoided as long as possible. The unlimited use of habit-forming drugs is to be condoned only in a terminal stage when every other resource has been exhausted.

2. *Surgery*. The surgeon has much to offer the incurable cancer patient. Regardless of how many metastases the patient has, surgical removal of bulky, bleeding, ulcerated, infected, or painful tumors brings enormous relief. Surgery is particularly useful in palliation of tumors which have proved radioresistant. The surgeon is frequently called on to excise radiation ulcers, and bone and cartilage which have become devitalized and painful following radiation.

The surgeon can relieve obstruction in the urinary and gastrointestinal tracts, a frequent occurrence during the course of an incurable cancer. He can resect or short-circuit, or carry out such procedures as gastrostomy, colostomy, cystostomy and ureteral transplantation.

3. *X-ray therapy*. X-ray therapy has been used long enough for compilation of statistics showing the percentage figures of response by various cancers. But it is still not possible to predict the response of an individual cancer. In general, the only way to determine the radiosensitivity of any one lesion is to subject it to radiation. It is the rare patient with advanced cancer whose tumor has not been proved radioresistant from whom radiation should be withheld.

The object of radiation in incurable cancer is palliation only. First, it should be used for pain relief. X-ray therapy relieves pain (1) by reducing the size of soft tissue tumors. This, in turn, relieves pressure on nerves and permits better vascularization which leads to healing of necrotic ulcers (internal as well as external) and clearing up of infection. (2) It causes recession of bone metastases. Frequently, bone that has been completely destroyed actually regenerates.

Second, it should be used to relieve the mechanical discomfort produced by the presence of bulky tumors. Here again, it is effective by reducing the size of the tumor.

Third, it should be used in the prevention and treatment of pathologic fractures. Bone metastasis in itself is usually a very painful

affair. When complicated by pathologic fracture, pain is intolerable. The patient with advanced cancer should be followed closely for the development of bone pain. Whenever x-ray examination reveals the presence of sufficient bone destruction for fracture to become a possibility, x-ray therapy should be begun at once. The patient and his attendants should be warned against use of the part and orthopedic appliances should be used as a protective measure. When fracture has occurred, the x-ray therapist and orthopedist should be consulted immediately. X-ray therapy frequently speeds healing a great deal.

In fact, in patients with known cancer, it is good practice to institute x-ray therapy for pain whether or not metastasis can be demonstrated radiologically. If the pain is due to metastasis, the lesion may be aborted before it has done much damage or caused much suffering. If the pain is not due to metastasis, the failure of response will so indicate. No harm will have been done and the symptoms can be further investigated.

Fourth, x-ray therapy should be used in an attempt to relieve distress other than that caused by bone metastases and nerve pressure. The headaches and neurologic disturbances produced by cerebral metastases often yield to radiation. The same is true of the cough, atelectasis, and pneumonitis incident to radiosensitive pulmonary metastases. Proptosis, superior mediastinal block, lymphatic stasis in the extremities due to extensive glandular metastases in the groin or axilla, obstruction in the intestinal or urinary tracts, all are complications which may be alleviated by radiation.

Relief of symptomatology and destruction of tumor tissue picks up the general condition. Hemapoiesis, nutrition, and mental outlook improve.

4. *Hormonal regulation.* The writer is a roentgenologist and will set down here only the fairly well established principles resulting from the work of people such as Adair, Haddow, Hermann, Huggins, Nathanson, Taylor and Treves, to mention a few of many who have contributed to this subject.

In incurable prostatic carcinoma, excellent and prolonged palliation may usually be obtained by orchiectomy, the administration of estrogens, or a combination of the two. A good response may be expected in 70 to 80 per cent of cases.

In incurable carcinoma of the female breast, good palliation is often achieved by alteration of the host's hormonal status. In the premenopausal woman, administration of androgens or sterilization by surgery or x-ray may result in prolonged recession of the disease. Surgical sterilization is preferable, as x-ray sterilization

does not cause complete cessation of hormonal production. In 15 to 30 per cent of cases, regression of osseous and pulmonary metastases, relief of pain, better hemapoiesis, and improvement in the general condition are observed. Seldom are the primary tumors and lymph node metastases greatly affected. Androgen therapy seems to be effective as frequently in the postmenopausal as in the premenopausal woman. Illogical as it seems, estrogen therapy, too, has produced favorable results in postmenopausal women. It should never be used before the menopause, and has proved most effective in the quite elderly. When responsive to estrogen therapy, it is the soft tissue manifestations of the disease which recede rather than the osseous metastases. Both androgens and estrogens occasionally accelerate the disease in the postmenopausal woman, and must be administered with caution. Also, androgen therapy sometimes produces severe hypercalcemia. The blood calcium level must be followed closely and therapy discontinued if it rises significantly.

In incurable carcinoma of the male breast, orchiectomy has led to responses comparable to those seen in carcinoma of the prostate.

Androgen therapy is sometimes helpful in controlling carcinoma of the ovary.

5. *Nitrogen mustard.* Its greatest usefulness is in disseminated Hodgkin's disease. It has a palliative effect on Hodgkin's disease comparable to that of x-radiation. Localized masses are best handled with x-ray, but disseminated disease can be attacked more efficiently by nitrogen mustard than by general body radiation or by radiation through an excessive number of portals. Nitrogen mustard is less effective in lymphosarcoma, and of even less value in leukemia.

6. *Urethane.* This drug is helpful in controlling chronic myelogenous leukemia. It seems to be of no practical value in the other forms of leukemia.

7. *Teropterin.* Pteroyl-triglutamic acid has proved to have temporary but worthwhile effect on advanced cancer of many varieties. Sometimes it produces actual regression of the disease, more often just a sense of well being. That alone makes it a useful addition to the physician's armamentarium. Experimental work is being carried on with related compounds.

8. *Radioactive isotopes.* Radioactive iodine has a place in the control of advanced cancer of the thyroid. Radioactive phosphorus has an effect on leukemia. In general, as far as practical value in treatment of cancer is concerned, the use of radioactive isotopes is still in an experimental stage.

Combinations of the Above

Perhaps the most important point to make in regard to the newer weapons available for control of advanced cancer is that enthusiasm for the new methods of treatment must not be allowed to lead to neglect of the old standbys, x-ray therapy and palliative surgery. In the great majority of cases, x-ray therapy is the most helpful form of treatment available. The newer forms of therapy are adjuncts, in some cases very valuable, in some only fairly helpful, in others useless. Even in carcinoma of the prostate, where hormonal regulation is so dramatically successful, x-ray therapy can play a rôle which some urologists are beginning to forget. When the disease escapes control by hormonal alteration, it may often be recontrolled by x-radiation. The best results, the most prolonged palliation, are obtained in this, as in other forms of treatment, plus palliative surgery.

Neurosurgery

Frequently overlooked in advanced painful cancer is the usefulness of neurosurgery. No discussion of incurable cancer is complete without mention of the enormous relief to be obtained, in selected cases, from such procedures as alcohol injection of nerve roots, rhizotomy, posterior root section, and cordotomy. Recently, brilliant results have been achieved by prefrontal lobotomy. The unilateral operation is coming to be preferred to the bilateral, and there is experimental evidence that topectomy (cauterization of the thalamic nuclei) may be more satisfactory yet.

Conclusions

1. Because only about 25 per cent of cancer is being cured, the handling of incurable disease is, from a practical standpoint, the most important cancer problem.

2. Palliation is well worth while, often resulting in years of active, useful life. It is best achieved by the skillful combination of surgery and radiation with the newer methods of treatment.

3. Administration of large amounts of opiates is the final measure, to be resorted to only when everything else has failed.

4. In persistently painful, advanced cancer, the neurosurgeon should be consulted.

LEPTOMENINGEAL CARCINOMATOSIS

An Unusual Metastatic Lesion from Carcinoma of the Breast

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Metastases from carcinoma of the breast to the central nervous system are relatively common. According to Ewing,[7] in 4 per cent of the cases, carcinoma of the breast metastasizes to the brain, and Bailey[2] found that the incidence was perhaps as high as 5 or 6 per cent. These metastatic lesions may be single or multiple. Intraspinal metastases from carcinoma of the breast are not uncommon, since most of these are extensions of bone lesions into the epidural space. Intradural lesions, however, are rare. Abner Wolf,[11] in a pathologic study of 253 intraspinal tumors, found 28 which could be classed as metastatic carcinoma. Of these, 4 were intradural, and in only 2 was there invasion of the leptomeninges or spinal cord itself. Both of these tumors were metastases from carcinoma of the lung and were primarily extradural.

Occasionally, carcinoma metastasizes to the leptomeninges. This rare condition is known as meningitis carcinomatosa or carcinomatosis of the meninges. These terms were first used by Siefert[10] in 1901. Alpers and Smith[1] in 1938 reported a case of meningitis carcinomatosa secondary to carcinoma of the lung. They stated that meningitis carcinomatosa confined to the spinal leptomeninges was much less common than the generalized type. A fairly complete review of the literature of this condition was made by Dixon, Kerr and Sharp[6] in 1946. These authors were able to collect 40 cases, most of which appear in the foreign literature. They emphasized that meningitis carcinomatosa should not be confused with carcinomatous metastasis to the dura mater as described by Russell and Cairns[9] in 1934. In order to differentiate these two conditions, we are using the term leptomeningeal carcinomatosis.

In the case which we are reporting, an incorrect diagnosis of arachnoiditis was made at the time of operation. The tumor nodules on the nerve roots and spinal cord were thought to be encysted lipiodol as had been described by Bucy and Speigel.[5] Most of the nodules were thought to be in the cauda equina and conus medullaris, but later when a cordotomy was performed they were found scattered throughout the leptomeninges as high as the second

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dorsal segment. The patient's symptoms, however, were those caused by a lesion confined to the lower end of the spinal cord and cauda equina.

Case Report

C. R. W. (U. of Va. Hosp. No. 256980), a well nourished 46 year old, white housewife, was admitted to the University of Virginia Hospital with the chief complaint of pain and weakness in her legs. She apparently had been in good health until 3 years prior to admission when she was found to have a mass in her right breast. Several months afterward, the mass was diagnosed as carcinoma, and a radical mastectomy was performed. This was followed by 28 deep x-ray treatments. After operation, the patient was asymptomatic until about 18 months prior to admission to this hospital when there was onset of an intermittent, aching pain in her right knee which became progressively worse. About 8 months after the onset of pain, the patient noted weakness of the right leg, and on two occasions she twisted her ankle and fell. As the result of the second fall, she sustained a fracture of the right ankle which was treated with a plaster cast. When the cast was removed, the patient was unable to walk without assistance. She then entered another hospital for diagnosis and treatment. A thorough examination, including myelograms, was performed, and she was discharged with the diagnosis of polyneuritis. During the few months prior to her admission to the University of Virginia Hospital, the patient developed lumbar and pelvic pain and noted numbness in the lower legs and buttocks. These symptoms progressed, and on admission she was unable to walk.

Neurologic examination revealed findings consistent with a cauda equina lesion. There was bilateral weakness of the legs, more marked on the right, and muscular atrophy was present. Reflexes in the lower extremities were markedly diminished, and no abnormal reflexes were elicited. All sensory modalities were absent below the right knee and diminished up to the inguinal ligament, while in the left lower extremity sensation was only diminished over the same distribution. There was incomplete analgesia of the saddle area, and urinary and bowel control was unimpaired.

X-ray examination of the chest, dorsal and lumbar spine revealed no abnormalities. Lumbar puncture on two occasions revealed a partial block. The total protein was 900 mg. per cent on one occasion, and 1125 mg. per cent on a second examination. No cells were found. Myelography was repeated with pantopaque, and a block was demonstrated at the level of the first lumbar vertebra. In view of these findings, a diagnosis of an intraspinal mass lesion was made and operation advised. It was felt that in spite of the absence of bone involvement a metastatic lesion was present, and decompression of the spinal cord and cauda equina was indicated.

At operation (J.M.G.), a laminectomy was performed at T-11, T-12, L-1 and L-2. No extradural abnormalities were noted, and the arachnoid appeared normal. On opening the arachnoid, the nerve roots were matted together by a thickened pia and innumerable adhesions. Several small, yellowish, cyst-like nodules were seen on the nerve roots and conus medullaris (fig. 1). We believed at that time that we were dealing with arachnoiditis, and the little nodules represented encysted lipiodol. An attempt was made to separate the dense adhesions, and a small biopsy, consisting of a nerve filament with a

nodule, was taken for pathologic study. Pathologic diagnosis of the specimen was "metastatic carcinoma invading the nerve root, consistent with carcinoma of the breast." (Dr. J. C. Cash.)

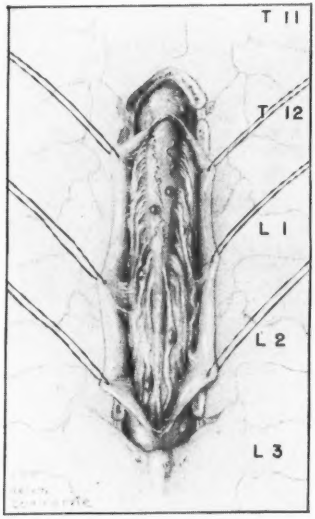

Fig. 1. Appearance of the conus medullaris and cauda equina at operation—the macroscopic tumor nodules and the adhesions are shown.

After operation, the patient experienced very little relief of pain, and there seemed to be no neurologic improvement. A course of x-ray therapy was started, but had to be discontinued because of severe leukopenia which persisted in spite of several blood transfusions and other supportive therapy. Five weeks later, a cordotomy was performed in order to alleviate the severe pain in the legs. At this operation in the upper dorsal spine, the arachnoid again appeared thickened, and there were 2 yellowish nodules seen in the exposed nerve roots. A biopsy of the arachnoid and posterior nerve root revealed the same findings as were reported from the first biopsy. Fortunately, the cordotomy was successful, and the patient was discharged neurologically unimproved, but free of pain.

Discussion

At operation, there seemed to be little doubt that we were dealing with arachnoiditis, but a biopsy was taken for confirmation. When sections were made, tumor cells were seen infiltrating the nerve root as shown in Figure 2. These findings are similar to those of Dixon, Kerr, and Sharp[6] who stated that infiltration of the nerve roots may result in macroscopic nodules, and that the neoplastic cells may or may not invade the nerve tissue itself.

The mechanism of a spread of carcinoma of the breast to the

leptomeninges is difficult to explain. Boyd[3] believed that the tumor cells originate from a metastatic focus in intimate relationship with the spinal fluid, such as the choroid plexus or the ventricular walls.

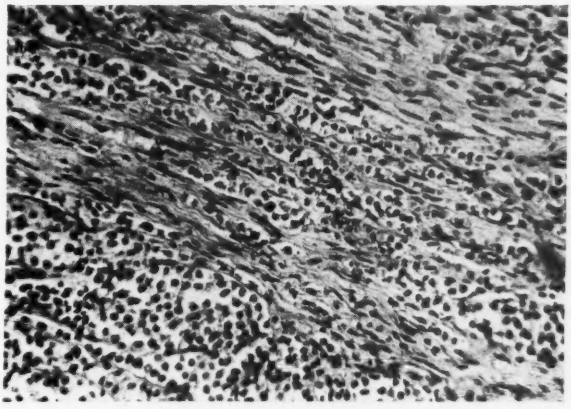

Fig. 2. Photomicrograph showing the neoplastic cells infiltrating the nerve root.

He suggested that in these cases examination of the spinal fluid would show tumor cells. In our case these cells were searched for, but none was found on two separate occasions. Brown and Kernohan[4] postulated that tumor cells may spread from adventitia of the pial vessels and secondarily invade the leptomeninges. They quoted experimental evidence to substantiate their opinion. Alpers and Smith[1] believed that the carcinoma spread was a direct extension along the intercostal nerve to the posterior root ganglion and from there to the meninges. It is obvious then that the mechanism of the production of leptomeningeal carcinomatosis is not settled, and it will be necessary to make further studies before any of the above theories can be accepted.

The clinical picture of leptomeningeal carcinomatosis varies considerably. In the case reported by Floyd[8] in 1944, the picture was that of polyradiculoneuronitis. In other cases, various clinical pictures have appeared from those of an acute meningitis to that of a transverse cord lesion. The diagnosis is seldom made during life, except in those rare cases in which tumor cells are sought for and identified in the spinal fluid. In most of the cases reported, diagnosis was made at autopsy, except those few in which a spinal cord tumor was suspected and the true nature of the lesion discovered at operation.

Summary

A case of leptomeningeal carcinomatosis secondary to carcinoma of the breast is reported. Its gross similarity to certain cases of arachnoiditis is suggested and the mechanism of its production discussed.

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RECENT ADVANCES IN SURGERY OF THE TEMPORAL BONE

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THERE has been a marked advance in surgery of the temporal bone in recent years, largely from the pioneering and stimulating work of Dr. Julius Lempert, of New York; and strange to say, this advance took place after many otologists felt that the day of surgery of the temporal bone was practically ended, from the use of chemotherapeutic and antibiotic drugs. As far as surgery was concerned in acute suppurative disease and its complications, it was practically ended; for in the University of Virginia Hospital, for instance, these agents had reduced the necessity for this type of procedure by approximately 90 per cent, and the same held true elsewhere.

Before the advent of these drugs, the technic of the so-called "simple mastoidectomy" had been perfected. A postauricular approach was employed, and the procedure was adequate in handling all the acute and subacute infections of the mastoid process, as well as the complications which resulted from these infections, such as phlebitis and thrombosis of the lateral sinus, meningitis, and epidural abscess. But when the postauricular approach was used for surgical intervention in the middle ear and petrous portion, it left much to be desired, since the minute anatomy of these structures could not be adequately visualized. Hence, many otologists were loath to operate on these suppurative diseases of the temporal bone, unless the need was urgent. The mallet with gouges and chisels were generally employed in dealing with the heavy bone so frequently found in this region. To meet these difficulties, numerous modifications of the so-called "radical operation" were devised, but none quite solved the problem.

Although operations on the mastoid process for acute infections were practically eliminated, there were still many patients with chronic suppuration of the ear which did not respond to therapy. These patients had acquired the infection before the advent of the newer drugs, or from neglect, or inadequate treatment. Although the number of such patients will no doubt decline as a newer generation grows up, it did not alter the fact that these patients continued to present themselves at this time with acute, painful flare-ups, facial nerve paralyses, meningitis, brain abscess, and labyrinthitis, which destroyed hearing. These infections were often due to

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bacteria such as B. proteus and B. pyocyaneus, which are notably resistant to treatment and produce a foul smelling discharge. Although these patients were operated upon successfully in most instances by the old classical methods, it was always done with many misgivings on the part of the surgeon, since he was handicapped by his lack of adequate visibility in dealing with so many intimate and important structures. Because of the fear of injury to the facial nerve or internal ear, diseased tissue was often left, and a dry ear was not obtained; although the primary objective which called for surgical intervention might have been achieved.

The surgery for deafness, particularly as applied to otosclerosis, was largely experimental at this time. Several operations were required, and only temporary hearing improvement was obtained. In other words, temporal bone surgery had met the challenge of acute suppurative disease and, with the assistance of the newer drugs, had conquered, but was unable to meet the challenge of chronic suppuration and relief of deafness.

It was at this period that Dr. Lempert proposed his endaural incision, which not only minimized scar and deformity, but offered such a direct approach to the vital middle ear structures that they could all be identified and treated surgically with assurance on the part of the operator. Properly to see these structures, brilliant headband spotlights and magnifying loupes are necessary. It was but a short step then for Dr. Lempert to extend his surgical ingenuity to the eradication of disease in the tympanum and petrous portion of the temporal bone, and to develop and perfect the one-stage fenestration operation for the restoration of hearing in clinical otosclerosis.

To carry out these delicate procedures, it was necessary to employ electrically motor-driven burrs, and since most of the otologists at this time had been trained in the use of gouges, chisels, and curettes, and the postauricular approach, they were loath to relinquish the old methods, until they had actually seen the amazing new anatomic view as presented by Dr. Lempert's technic.

To duplicate this view, it became necessary for otologic surgeons to learn the endaural approach, the use of the electrically driven burr, and the anatomy of the ear when viewed from this new angle, by cadaver surgery. For nowhere else in the body are so many important vital structures so closely associated, with distances from one such structure to another measured in millimeters and many encased in hard bone. Errors of anatomic judgment in any of these various operations could quickly result in injury to the tympanic membrane, the ossicles, the facial nerve, the dura, the labyrinth,

the cochlea, the jaw joint, the lateral sinus and jugular bulb, or the carotid artery. Such accidents are frequently serious, not only to function, but even to life.

The leadership of Dr. Lempert in the application of these new surgical concepts and their adoption by a rapidly increasing number of otologists have led to such a rapid advance in surgery of the temporal bone that no part is now inaccessible, and the challenge of chronic suppuration and deafness is now being met with confidence on the part of the surgeon and safety for the patient.

The endaural approach, using this new armamentarium, has now been successfully applied to all the surgical problems of the temporal bone. Occasionally a secondary postauricular incision in the edge of the hair line is employed to gain direct access to the posterior portion of the well pneumatized mastoid, and in dissection of the facial nerve. But in these instances, this incision is carefully closed, and does not produce a visible scar or deformity.

Among the advances in temporal bone surgery are:

(1) Local anesthesia after sedation with phenobarbital, whenever possible, followed by general anesthesia with pentothal sodium or inhalation, when necessary.

(2) Minimal scar and deformity.

(3) The free use of split skin grafts to facilitate healing, to prevent scar contracture, and to preserve hearing.

(4) A marked reduction in operating time, by use of the electrically driven burr.

(5) Increased safety to all vital structures, by brilliant illumination and inspection with magnifying loupes.

The endaural approach has been used satisfactorily in the following procedures:

(1) The destruction of the static labyrinth in severe Menière's disease when accompanied by loss of useful hearing.

(2) The destruction of the intratympanic sympathetic plexus in selected cases of severe tinnitus.

(3) The removal of bony exostoses of the canal wall.

(4) Apicectomy in suppuration of the petrous tip.

(5) Mastoidectomy in selected cases.

(6) Mastoidotympanectomy, complete, in chronic suppuration.

(7) Mastoidotympanectomy, partial, in certain cases of attic cholesteatoma, with preservation of the drum and the utilization of

the post canal wall skin flap, when the middle ear proper is not diseased.

(8) The plastic repair of old postauricular fistulæ.

(9) The repair, suture or nerve grafting in paralysis of the facial nerve.

(10) For the restoration of hearing by fenestration of the ampullated end of the external semi-circular canal in clinical otosclerosis with fixation of the stapes, and for the same purpose in certain other cases of chronic deafness.

(11) For the approach to the surgical correction of suppurative complications, such as lateral sinus phlebitis and thrombosis, epidural abscess, and meningitis of otitic origin.

Conclusions

The advances in temporal bone surgery are comparable to any of the advances in surgery in recent years, and, as a result, otologists are now confidently operating upon these difficult problems and restoring the hearing to hundreds of patients who, a few years ago, had no alternative but to wear a hearing aid.

The Southern Surgeon

Published Monthly by

The SOUTHERN SURGEON PUBLISHING COMPANY

701 Hurt Building

ATLANTA 3

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Subscription in the United States, $5.00

VOLUME XV FEBRUARY, 1949 NUMBER 2

A THREAT TO SURGICAL TRAINING?

The first interest of every surgeon, whether engaged in surgical practice or in the training of young men to become surgeons, is the well-being of the patient. Surgeons in practice are primarily concerned with individual patients; those engaged in training—and that group includes all surgeons practicing in well-staffed hospitals, whether attached to medical schools or not—have in addition a wider influence. Their responsibility includes an interest in the good care of all the surgical patients with whom their students will be concerned over the years. What and in what manner they teach will affect the lives of countless people in ever-widening horizons.

The present comments are concerned only with the manner of training surgeons. Historically, there have been three methods. The earliest, lasting from the dawn of surgical intervention to the beginning of the art of surgery as such, was self-training. The practitioner, faced with a situation in which mechanical therapy seemed indicated, did what he thought best and learned from the doing. He was the pioneer of surgery with no accumulation of surgical knowledge on which to rely. He did the best he could, and his patients often derived benefit from his interventions. It is obvious that in modern times this approach to training is obsolete. The

second approach, apprenticeship to an established surgeon, may under the best conditions still constitute good training. Because this method offers most often only an observer's opportunities without actual personal responsibility for surgical care, it has largely been superseded by the modern hospital training program of which the residency organization is the typical example. As properly developed, this program gives the young man a graduated introduction to surgical technics and responsibilities, large opportunities to observe the work of older surgeons, and finally, in the terminal year or years, major surgical responsibility both in operating and in the care of patients. Throughout the period of training the fundamental principles behind surgery are continuously taught. Most important of all, the individual patient is protected by close supervision by experienced surgeons both in the wards and at the operating table. Under this organization not only are the resident's patients in the hospital protected from bad surgical management, but also such effective training can be given that all of his future patients are assured good care. The only way to learn to operate is to operate; and the method described assures safety for the patient while the beginner is gaining his operative experience.

It has been an established tradition that the patients whose financial capacities do not enable them to command the services of a surgeon of their choice constitute the material that is available for resident training. This does not mean that these patients pay for care by accepting an inferior grade of surgical management. As a matter of fact, the quality of surgical care rendered by residents in first rank training centers compares favorably with the average quality of surgery performed throughout the country. It means only that such patients forego the personal choice of a surgeon. Their interests are conserved by careful choice of the residents to whom they are assigned and by detailed supervision on the part of the visiting staff.

The present direction of sociologic tendencies is threatening the availability of material for surgical training. Even now the effect is apparent. One first-rate teaching hospital attached to a nongovernmental medical school has seen its ward material diminish from an average of about 85 per cent of its admissions in 1940 to about 15 per cent in 1946. In another outstanding university hospital practically all ward admissions have ceased during the last year. Part of these changes are the result of the need for self-preservation on the part of the hospitals concerned, which can no longer afford the luxury of admitting patients who can pay nothing or a sum incommensurate with the now appalling cost of hospital care. Although it is probable that the increasingly complex technics

demanded for first-rate diagnosis and therapy will tend to force the cost of medical care even higher, yet a factor in the recent extraordinary increase in cost is an economic pattern that can be expected in part at least to be transient.

The fundamental threat to surgical training comes from a different quarter, namely, the trend toward the spreading of the cost of medical care over the populace as a whole, the insurance principle in medical care, whether it be voluntary or compulsory. This is not the place to debate the relative merits of voluntary or governmental medical care plans. Few sound thinkers in medicine favor the latter. The point is that under either scheme the principle of the free choice of a physician is almost certain to be stressed just as it already has been made the chief attack on federally controlled medicine. It is not difficult to foresee a time when every patient asking admission to our hospitals will, by virtue of his contribution to his insurance coverage, consider himself entitled to name the surgeon to operate upon him.

It may well be asked what then will become of the training of surgeons and, by way of corollary, what then will become of American surgery. Of course, young surgeons in training will still see a great volume of surgery and will watch older surgeons at work. This together with technical experience gained in operating on animals will perforce constitute surgical training. The trainee must thereafter assume the responsibility of a surgical practice without ever having had the opportunity of assuming such responsibility under circumstances in which his work is observed and criticized and in which he can call for help if he needs it. Of course, good surgeons will develop under these conditions, but they will develop at the expense of the first patients who come to them. An imagined advantage to the individual patient who offers his insurance as proof of his rights will result in harm to countless prospective sufferers from surgical diseases as the present properly trained group of surgeons fades gradually from the picture.

No one denies the psychologic soundness of the principle of free choice of physicians. However, in the discussions of the matter it has not often been stressed that in large hospitals and clinics this free choice has long been non-existent without appreciable harm either to the patient or to the patient-physician relationship. This is a part of the traditional structure of American medical practice which most of us are striving to preserve. We must not be blind to the possibly disastrous consequences of destroying this basic part of the structure. It appears to be an urgent necessity that medical statesmen consider the problem of technical training in surgery and

the surgical specialties under universal voluntary or compulsory insurance conditions of medical practice. Too little has been said about it. Unless thought is given to it and some method is devised whereby a part of the surgically sick can be assigned to the care of properly chosen and supervised residents in training, we may wake up to a situation in which no adequate training is possible.

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